FROM THE SANATORIUM FOR TUBERCULOSIS IN THE BONES AND JOINTS, KAKASSZÉK AND THE CENTRAL RESEARCH INSTITUTE OF THE BLOOD TRANSFUSION SERVICE, BUDAPEST, HUNGARY

ARTHROPLASTY USING OF BIOPLAST IN TUBERCULOUS COXITIS

By

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In the therapy of articular tuberculosis the aim has for a long time been to preserve the mobility of joints, but up to recent times there has not been much chance of success. The advent of antituberculotics raised great hopes also in this sphere and, in fact, the number of spontaneously healed mobile joints has increased, particularly in cases where treatment was started early enough. Unfortunately, arthroplasty with the application of metal or synthetic interpositums to promote mobility did not yield good results and in the literature opinion became general that the use of vitallium or acrylate caps in tuberculosis of the joints was contraindicated.

The absorbable cap produced from fibrin powder by high pressure represents a significant advance (Fig. 1). This synthetic material of protein named bioplast shows affinity with the tissues, contains no toxic or carcinogenic substances, and possesses the required consistency and elasticity; more important than any other quality, however, is its susceptibility to being broken down by proteolytic enzymes and absorbed. By the aid of chemical pre-treatment, absorption time can be regulated to take from three or four weeks to seven to eight months, as required.

The first models were given a trial in the hip joints of dogs by Zinner, Gerendás, and Biró (11), and then, on the basis of the results, in clinical practice. A fibrin cap—fashioned to fit the joint in shape and size—placed on the femoral head prevents merging ossification of contiguous articular endings. After operation the cap promotes mobility of the limb, and under its protection cartilage develops on the articular surfaces owing to the influence of function. Finally, six to eight months

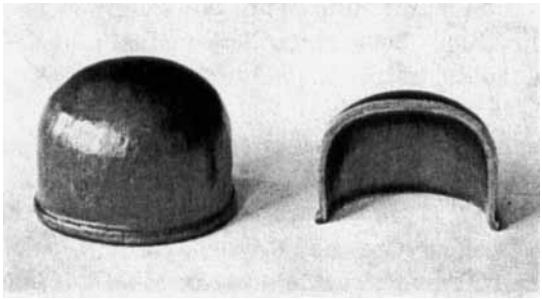

Fig. 1.
Bioplast cap.

following implantation—when regeneration has run its course—the cap is absorbed and disappears without leaving behind any trace. This circumstance ensures in the most favourable manner free motion of the joint (2, 3).

Therapy of tuberculous coxitis aimed at restoring motion calls for consideration of three aspects:

Whether maintenance of, or insistence on, motion involves no danger of relapse.

Differentiation of cases where mobility is desirable from those where stable, stiff joints offer an advantage.

The most suitable procedure for obtaining good motion in articular tuberculosis.

1) Prior to the introduction of antituberculotics the view was as good as unanimous that a tuberculous process can be healed only by complete ossification; therefore the objective was to stiffen the joint at any price. However, observations recorded during the ten years that have elapsed since initiation of the use of antituberculotics have drawn attention to many angles that might lead to more complete healing of tuberculosis in the joints (1, 4, 6, 10).

For several years full recovery and satisfactory motion have been noted in the treatment of early, superficial, or synovial processes. In most instances, well-functioning joints have been obtained after elimination of foci and necrectomy. Resection in coxotuberculosis has also been followed by uneventful recovery, as well as restoration of good motion within a few months, and the favourable results persist after the passage of several years. Hence in these cases the maintenance of motion has exerted no harmful effects on the course of tuberculosis. Still more encouraging is the fact that the dreaded dangers of former

times, miliary and meningeal dissemination, have not been encountered among our more than 3000 cases of osteotuberculosis treated in the last ten years. It is therefore plausible that we are in favour of restoring motion (7).

2) In our experience, endeavours to retain motion are worthwhile in every case where the slightness of articular destruction permits hope of success. If after a time it becomes obvious that the joint shows functional insufficiency associated with pain and inadequate capacity, only then is the stabilizing operation performed. To further our efforts we omit—if possible—the application of plaster and employ intensive water cure and physiotherapy when tuberculosis has assumed quiescence.

3) The literature agrees on the point that arthroplasty with vitallium and other prostheses does not produce favourable results and is thus contraindicated in general (5, 8). However, as evidenced by our experiences, fibrin caps, too, ensure the maintenance of motion, while owing to absorption, their use is free from the serious disadvantages of prostheses; moreover, they contribute to the development of smooth articular surfaces and are well tolerated by tuberculous tissue.

In 1955 these considerations induced us to begin the use of fibrin caps in hip resections. So far we have performed twenty operations. The present paper gives a report on ten cases where the follow-up period since surgery has been two to three years. The results of later operations are not evaluated here, but we may remark that they are equally encouraging.

METHOD

Our operated cases include five male and five female patients (Table I).

Pretreatment usually takes one to three months. Rest is ensured by extension, in the presence of severe pain, by plaster. As medicamentous therapy Streptomycin (SM) + isonicotinic acid hydrazide (INH), or INH + para-aminosalicylic acid (PAS) are administered in combination. The object of pretreatment is to obtain regression. If destruction increases and the joint is threatened by the danger of more extensive destruction, the patient is operated on without delay.

Indication.—Stiffness and limited mobility of the contralateral side constitute absolute indications for surgery. Apart from these symptoms, slight destruction in the case of children, young women, and persons with a sedentary occupation is also regarded as an indication for surgery. Patients having to perform difficult movements in an up-

TABLE I

No.	Name	Age	Sex	Onset of disease years	Diagnosis	Histology
1.	B.J.	8 years	boy	½	Tuberculous coxitis, right side	Tuberculosis
2.	K.M.	14 years	girl	4	Tuberculous coxitis, right side	Regressive tuberculosis
3.	B.T.	19 years	girl	2	Tuberculous coxitis, left side	Caseous tuberculosis
4.	Sz.Zs.	23 years	girl	6	Tubercolous coxitis? left side	Chronic inflammation
5.	B.J.	12 years	boy	1	Tuberculous coxitis, right side	Regressive tuberculosis
6.	B.L.	16 years	boy	1	Tuberculous coxitis, right side	Regressive tuberculosis
7.	M.M.	8 years	boy	5	Tuberculous coxitis, right side, tuberculous spondylitis, in dorsal vertebrae 8, 9, 10, 11	Regressive tuberculosis
8.	Sz.Gy.	15 years	boy	½	Tuberculous coxitis, right side Dislocation of coxa, left side	Caseous tuberculosis
9.	F.M.	9 years	girl	½	Tuberculous coxitis, left side	Tuberculosis
10.	H.E.	32 years	woman	¼	Tuberculous coxitis, right side	Granulation, tuberculosis?

right position fare better with stable, stiff joints. However, final decision usually depends on surgical findings; in most cases of hip resection we therefore make preparations also for the use of arthroplasty with a fibrin cap.

Surgical Technique.—Exposure is performed by Smith-Peterson's incision (9). The diseased articular parts are removed by resection and the surfaces are shaped as in preparation for plastic surgery with vitallium. Any defects of the head or the articular acetabulum are filled with "blood cake", chips taken from the hip bone, SM and penicillin powder. The "blood cake" is made by mixing of blood from the cavity and fibrin-thrombin powder. After filling of the defects, the cap is pulled on the femoral head. If the chief site of infection is in the articular acetabulum, a cap of adequate size is placed in the latter and the head set. In the case of active, suppurative processes, through drainage is applied and after operation plaster is put on the pelvis for a period of two or three weeks. Irrigation with a solution of SM + INH + penicillin is effected daily until the development of secretion has ceased completely, which generally ensues in four to ten days. In regressive, cicatrizing processes, drainage and plaster are omitted; preference is given to extension traction.

After-Treatment. Mobilization of the affected limb requires the most careful individual consideration. Initiation of active and passive movement in bed should rely strictly on clinical, laboratory, and X-ray findings. As a rule, perfect rest is observed for two to four weeks, then physiotherapy is gradually introduced, followed by baths and subaqueous exercise. Usually, the patient begins to move about with crutches after two or three months, while treatment is continued. The time for starting unaided movement is determined by the patient's condition and capacity. Antituberculotics are administered during the whole time of therapy (Table II).

CASES

Ten patients have been followed up for two or three years (Table III)[1]. The most encouraging results are demonstrated by the fact that the tuberculous process has healed in all of these ten cases, articular capacity is good, the patients use no aid and walk without pain.

Perfect motion has been obtained in three cases; in one case motion

[1] Our cases are under control at present since five years. They are showing further improvement. Our new cases are also successful.

TABLE II

No.	Pretreatment			Operation	After-Treatment			
	Time months	Stabilization	Drug employed	Date	Extension Plaster Bed rest months	Initiation of physio-therapy bathing months	Start in using bathing months	Start of unaided walking months
1.	2	plaster	SM, INH	Sept. 15, 1955	1	1	4	6
2.	3	extension	SM, INH	Oct. 25, 1955	1	1	2	3
3.	2	extension	SM, INH	Oct. 20, 1955	1+1	1	8	11
4.	2	plaster	SM, INH	Oct. 25, 1955	1	1	6	8
5.	9	extension	SM, INH, PAS	Nov. 29, 1955	1	1	2	4
6.	4	extension	SM, INH, PAS	Jan. 10, 1956	1	1	2	3
7.	6	plaster	SM, INH, PAS	Jan. 12, 1956 July 8, 1955 Spondylodesis	1	1	1½	4
8.	2	extension	SM, INH, PAS	Febr. 2, 1956	1	1	2	24
9.	6	extension	SM, INH, PAS	Jan. 24, 1957	5	5	6	8
10.	2	extension	SM, INH	April 2, 1957	1	1	2	12

TABLE III

No.	Motion per cent				Tuberculosis	Pain upon motion	Load-bearing capacity	Time of results months	Follow-up period years
	Before operation	After operation							
		flexion	abduction	adduction					
1.	painful contractura	100	100	100	healed	absent	excellent	6	3½
2.	absent	30	20	20	healed	absent	excellent	8	3½
3.	painful contractura	90	100	100	healed	slight	good	24	3½
4.	absent	bone anchylosis			healed	absent	excellent	8	3½
5.	absent	50	20	20	healed	absent	excellent	6	3½
6.	absent	80	100	100	healed	absent	excellent	12	3¼
7.	absent	40	20	20	healed	absent	good	6	3
8.	painful contractura	50	50	50	healed	absent	improving	24	3
9.	absent	50	10	10	healed	absent	excellent	9	2
10.	painful contractura	90	100	100	healed	slight	good	18	2

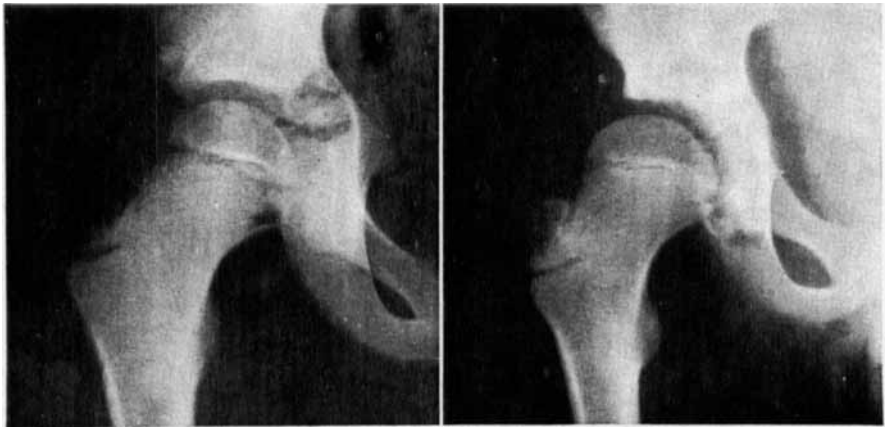

Fig. 2-A. *Fig. 2-B.*

Fig. 2-A. Radiograph prior to operation. Presence of sequestrum in the acetabulum is clearly visible at Y cartilage.

Fig. 2-B. Radiograph after one year following operation. The actetabular focus has been completely filled.

is good, in five satisfactory but not quite complete. In one operated patient subluxation was followed by anchylosis. Since entire freedom from symptoms persists, no fresh operation has been undertaken.

For the purpose of illustration, three case records are presented in detail.

Case No. 1. J.B., a boy aged 8 years, was admitted on July 13, 1955, with complaints of six months' standing in the right hip joint. At admission a 150° flexion-adduction contracture was found, causing intense pain on every attempt at motion, particularly upon abduction, adduction, and extension. The periarthric region was swollen. A plaster bandage was put on the pelvis and a course of SM+INH treatment started. The general condition improved, but as radiology revealed increased destruction of the acetabulum (Fig. 2-A), surgery was undertaken on Sept. 15, 1955. The articular soft parts were found to be caseous, the acetabulum cartilage was completely destroyed and at the Y chondrus there was an approximately nut-sized bone destruction spreading towards the pelvis. The femoral head appeared to be intact. After complete cleaning of the acetabulum, the surface was reformed and the acetabular defect sealed with a fibrin cap. Postoperative treatment consisted of extension and the administration of SM+INH. After a month the process was compensated, thus active and passive physiotherapy was begun in bed and completed by subaqueous exercises. In the fourth month the patient could use crutches, was free from complaints, and in the sixth month was able to walk unaided. Since his discharge on May 21, 1956, we have seen the patient every three months, last time on January 18, 1959. As shown by radiology, the bone defect has been fully replaced in one year. Motion is completely free and painless; capacity is good (Figs. 2-C and D).

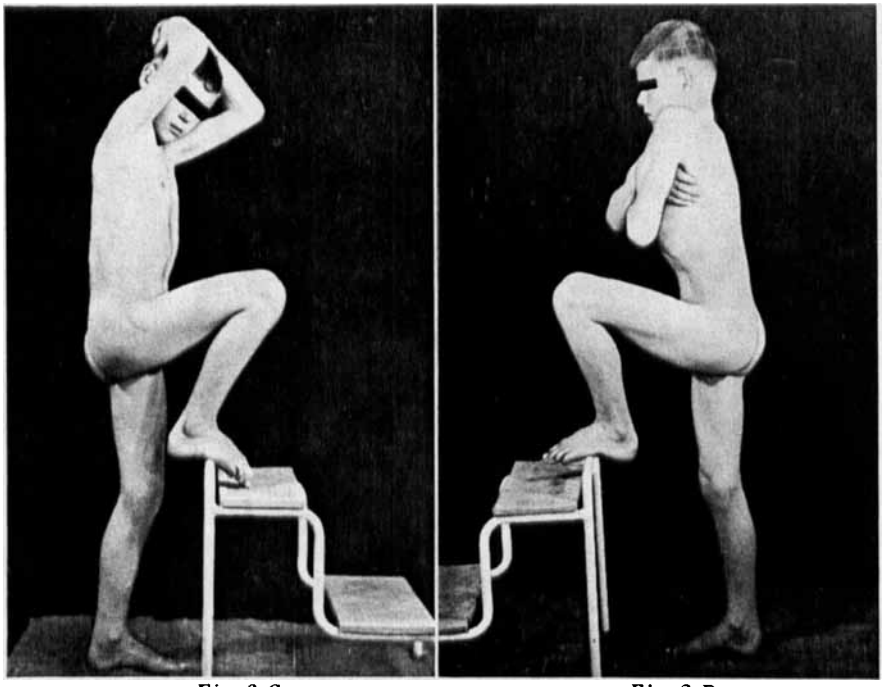

Fig. 2-C. *Fig. 2-D.*

Fig. 2-C. Perfect motion of the right hip restored in six months.
Fig. 2-D. Statically complete function in the right hip.

Case No. 2. L.B., a boy aged 16 years, was admitted on October 20, 1955, with complaints of 12 months' standing. He had been given INH+PAS, his abscess had been tapped several times and he wore a walking machine. At admission the joint was fixed, a few degrees' motion occasioned severe pain, and at the side over an area as large as a palm some fluctuation could be suspected. Operation was performed on January 10, 1956. Preoperative radiology (Fig. 3-A) had disclosed an uneven, constricted articular orifice and small foci in the acetabulum as well as in the femoral head, with sclerotic environment. Surgical findings accordingly showed cicatrized granulation and destroyed cartilage. An abscess filled with turbid exudate was found between the buttocks. Histological investigation confirmed the presence of regressive tuberculosis. After operation (arthroplasty with fibrin cap) a plaster bandage was left on for two weeks; extension and SM+INH were employed concurrently. In a month the patient's condition had greatly improved. Active, passive, and subaqueous exercises were carried on and some walking with crutches allowed. When discharged on April 16, 1956, he could walk without crutches, without any pain; flexion was 60°. Since then he has been seen every three months, the last time on January 18, 1959. A year after being discharged, the patient had no complaints whatever, flexion amounted to 90°, and radiology showed the formation of cartilage in the joint (Fig. 3-B). Support was found to be excellent (Figs. 3-C and D).

Fig. 3-A.

Fig. 3-B.

Fig. 3-A. Preoperative radiograph of right hip. The joint is uneven, constricted, destroyed, but signs of sclerosing are visible.

Fig. 3-B. Radiograph six months after operation. Articular cartilage surface is developing.

Fig. 3-C.

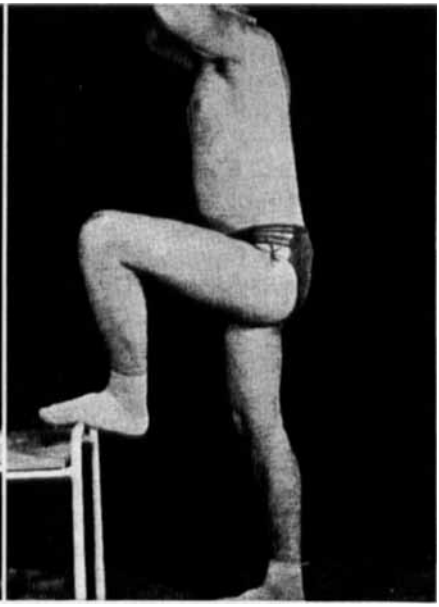

Fig. 3-D.

Fig. 3-C. Painless 60° flexion one year after operation.

Fig. 3-D. Statically excellent function in right hip.

Fig. 4-A.
Preoperative radiograph of pelvis. In the left hip congenital dislocation of the coxa. Complete absence of support. On the right, the iliac focus visible over the outer part of the acetabulum, has invaded the latter.

Fig. 4-B.
Reverse radiograph of right hip. The process threatened to destroy the whole coxa, therefore surgery was undertaken immediately.

Case No. 3. Gy.Sz., a boy aged 15 years, was admitted on November 16, 1955, with complaints of six months' standing in the right hip. Congenital dislocation of the left coxa was associated with a 12 cm. shortening and the abscence of static function (Fig. 4-A). An abscess had developed on the right side. As pre-treatment we employed SM+INH, INH+PAS, extension, then incision and topical treatment of fistula and abscess, with SM+INH solution. Since in reverse radiology the coxa showed increased destruction of the acetabulum and the femoral head was suspected of sequestration, we decided on surgery. The operation was performed February 2, 1956. Right side hip joint resection was performed along with iliac necrectomy, arthroplasty with bioplast, and excision of the fistula. As verified by surgical findings, a green-nut-sized acetabular focus had spread and invaded laterally the joint. The synovia and the cavity displayed tuberculous destruction. The greater part of the femoral head was affected together with the cartilage, there was atrophy but no sign of sequestration. The diseased parts were removed and the articular surfaces re-formed. When the resulting defects had been filled with a mixture of SM + penicillin and clotted blood, the fibrin cap was fitted on the femoral head. Then, by a separate incision, the fistula and the abscess were excised to the line of healthy tissue. Histological investigation confirmed caseous tuberculosis. After operation a plaster bandage was applied and SM+INH, later INH+PAS were administered. The patient showed remarkable improvement; in three weeks the plaster was removed, active and passive physiotherapy was initiated in bed, and subaqueous exercises were soon added. After two months the patient was allowed to get up and he began to move about with crutches; by the end of five months all symptoms had vanished and the hip joint was capable of 30°, painless motion. He was discharged on June 24, 1956, subsequently reported for follow-up examination every three months and

Fig. 4-C.
After two years, the patient walked without crutches; support is good.

Fig. 4-D.
Cartilage surface began to develop eight months following operation.

Fig. 4-E.
Radiograph taken twenty-four months after operation. The tuberculous process has been healed, the cartilage is becoming stronger. The limb is rotated forward, owing to use and luxation.

continued to take INH+PAS. After the elapse of two years he could walk well without any crutches, and capacity was good (Fig. 4-C); flexion was 40°; abduction, 20°; adduction, 20°. According to radiographic evidence, the process has healed completely, articular surfaces have developed, but the limb has a rotary position (Figs. 4-D and E). In this case the result of operation is manifested by inhibition of total articular destruction and by restored motility.

DISCUSSION

The experience and observations of several years have furnished proof that by the help of antituberculotics and appropriate surgical intervention, articular tuberculosis can be healed, without loss of

motility by the joint. This applies chiefly to synovial processes and to cases with slight destruction discovered at an early stage and given immediate medical care.

Since the year 1955, articular resection complemented with fibrin cap arthroplasty has been performed in 20 cases of tuberculous coxitis. A follow-up period of two-three years justifies the statement that operation is worth while in every case where destruction is slight and the patient's mode of life calls for restoration of articular motility. The most significant success achieved by our operations performed to obtain mobile joints has been the healing of the tuberculous process in each case. The conditions of such results are as follows:

Surgery should preferably be performed in the regressive stage, attained by two-three months of stabilizing treatment with drugs. If the process nevertheless shows progression, surgical intervention may be undertaken earlier in order to save the joint. However, in such cases after-treatment has to be cautious, which unfortunately limits the scope of movement.

Use of the fibrin cap in arthroplasty in the presence of tuberculosis constitutes an advance. The substance is neutral to tuberculosis, does not give rise to any reaction, and the development of cartilage proceeds favourably under its protection. Radiography has shown that in three to six months the developed cartilage can be visualized by X-ray.

The extent of motion depends on the condition of the muscles and the soft parts, on cicatrization which—unfortunately—is marked in recovery from tuberculosis. This consideration has induced us to avoid plaster bandages where possible, and to employ them only in the case of intense pain.

The program of after-treatment is the most essential factor of therapy and has to be adjusted individually to the patient. Establishment of a schedule prescribing both the period and measure of stabilization, exercise, bathing, moving about with crutches, and unaided walking, demands great circumspection, and has to be supported by clinical, laboratory, and x-ray investigations. From our experiences in hip resection we have drawn the conclusion that in the case of adherence to prudent measures, regression may be expected to set in within four to six weeks.

Finally, it may be stated that, owing to modern diagnostic and therapeutic procedures, the healing of articular tuberculosis without loss of motion is possible and should be exploited to the utmost. Hip resection combined with use of the fibrin cap is also one of the methods

serving the purpose of complete restoration in some cases of tuberculous coxitis.

SUMMARY

1) The authors report on ten cases of tuberculous coxitis in which mobile joints were obtained by the use of fibrin caps in hip resection.

2) These patients have been followed-up for a period of three years. Judged by healing of tuberculosis and articular capacity, results are excellent, motility is satisfactory.

3) In every process attended by slight destruction or upon compelling indication, surgery is recommended, particularly in the case of children and young women.

4) The fibrin cap does not prevent regression of the tuberculous process, it ensures mobility, promotes the formation of cartilage and, after having fulfilled its task, is absorbed and vanishes without leaving behind any trace.

RESUME

1) Les auteurs rendent compte de dix cas de coxite tuberculeuse dans lesquels il a été obtenu des articulations mobiles au moyen d'une capsule de fibrine dans la résection de la hanche.

2) Ces malades ont été suivis pendant une période de trois ans. Si l'on se base sur la guérison de la tuberculose et la capacité articulaire, les résultats sont excellents, la mobilité est satisfaisante.

3) Dans tous les cas chez lesquels il est question soit d'une légère destruction, soit d'une indication péremptoire, l'intervention chirurgicale est recommandée, en particulier chez les enfants et les jeunes femmes.

4) La capsule de fibrine n'empêche pas la régression du processus tuberculeux, elle assure la mobilité, favorise la formation de cartilage et après avoir rempli sa mission elle est absorbée et disparaît sans laisser aucune trace.

ZUSAMMENFASSUNG

1) Die Verfasser berichten über zehn Fälle von tuberkulöser Coxitis, in denen bewegliche Gelenke mittels der Verwendung von Fibrinkappen bei der Hüftgelenksresektion erhalten wurden.

2) Diese Patienten wurden während einer Zeitspanne von drei Jahren beobachtet. Hinsichtlich der Heilung der Tuberkulose und der Ge-

lenksfunktion waren die Ergebnisse ausgezeichnet und die Beweglichkeit war zufriedenstellend.

3) In jedem Prozess, der mit leichter Zerstörung einhergeht oder bei zwingender Indikation wird der chirurgische Eingriff anbefohlen, besonders bei Kindern oder jungen Frauen.

4) Die Fibrinkappe verhindert das Zurückgehen des tuberkulösen Prozesses nicht, sie sichert die Beweglichkeit, befördert die Knorpelbildung und wird resorbiert nachdem sie ihre Aufgabe vollführt hat ohne irgend eine Spur zu hinterlassen.

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