Rheumatic surgery—overview

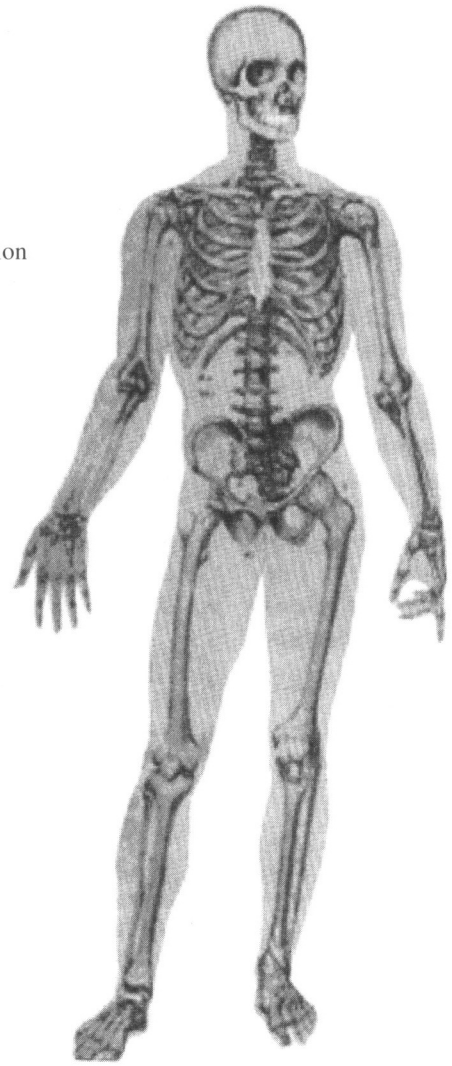
Shoulder
- Prosthesis
- Synovectomy
- Lateral clavicular resection

Wrist
- Synovectomy
- Arthrodesis
- Prosthesis
- Tenosynovectomy
- Neurolysis

Hand
- Tenosynovectomy
- Arthrosynovectomy
- Prosthesis
- Arthrodesis

Middle foot
- Arthrodesis
- Osteotomy

Forefoot
- Osteotomy
- Joint resection
- Great toe arthrodesis
- (Prosthesis)



Cervical spine
- Fusion
- Laminectomy

Elbow
- Synovectomy
- Prosthesis

Hip
- Prosthesis

Knee
- Synovectomy
- Prosthesis
- (Osteotomy)

Ankle
- Arthrodesis
- Prosthesis
- (Synovectomy)

Surgical treatment—general opinions

- Assessment of a rheumatic patient's need for surgical treatment and the advantages, disadvantages, and sequence of various surgical procedures is best performed in a team organization.
- A rheumatic surgery team may consist of a rheumatologist, orthopedic surgeon, hand surgeon, physical therapist, occupational therapist, and social worker.
- The aim of surgery is to achieve one or more of the following treatment goals:
  - pain relief
  - functional improvement
  - prevention of deterioration (prophylaxis).
- The desires and motivation of the patient are important factors in determining the indications for surgery.
- Contraindications of surgical treatment may include: increased surgical risk due to general medical disorders, pharmacological treatment (infection and bleeding complications, osteoporosis), and lack of motivation or unrealistic expectations by the patient.

Introduction

Mainly, the conditions that lead to surgical treatment are delayed manifestations of chronic inflammatory joint disease involving destruction of joint cartilage, joint capsules, and ligaments, followed by joint pain, movement limitations, instability, and malalignment. Far from all patients with rheumatoid arthritis will need rheumatic surgery during their lifetime. However, patients who require surgical treatment often need several, and in some cases many, operations.

Assessment of a rheumatic patient's need for surgery should be done in collaboration among the patient and a rheumatologist, orthopedic surgeon/hand surgeon, physical therapist, occupational therapist, social worker, and other medical staff. The participants in such a treatment team must always take a holistic view and be aware of the different paradoxical effects that isolated joint interventions might have in multiple joint disease. For example, a knee prosthesis in a patient with valgus deformity may provide pain relief not only for pain in the operated knee joint, but also for pain in the middle foot secondary to knee malalignment. On the other hand, bilateral prostheses in the knee joints may lead to increased symptoms in hip joints of patients who have not been able to walk for a long time. In some cases, problems in the upper extremities may be relieved by operating on the lower extremity and thereby free the patient from assistive walking devices that often lead to overloading the arms. The sequence of various planned surgical interventions must also be discussed among the team and with the patient. To become familiar with a patient's ability to cooperate in rehabilitation, surgical treatment should initially involve a minor procedure of documented benefit, in the hand or foot. Examples are arthrodesis of the base joint of the thumb, and various forefoot operations.

Preoperative and postoperative evaluations should be performed, not only regarding ADL function, but also regarding the patient's social and professional function.

It is characteristic for patients with chronic inflammatory joint disease to have reduced calcium levels in bone (osteopenia), which is part of the disease but which is also accentuated by long-term steroid treatment and inactivity. This causes bones to weaken, which is an important factor, eg, when assessing the possibilities for fixation of an endoprosthesis.

The risk for permanent deformity (contractures) contraindicates long-term bedrest or long-term immobilization of joints. Hence, surgical procedures must be planned and performed to allow early postoperative mobilization.

In general, the outcomes of joint surgery in rheumatics differ both clinically and radiologically from those achieved in patients with other joint diseases. This is probably due to the limited demands on mobility and strength in rheumatic patients and the limited strain which a patient with polyarticular joint disease places on reconstructed joints [3,4,6,12,19].

Procedures

Arthrosynovectomy (removing inflamed synovial membrane)

This surgical method was introduced in the 1950s to relieve pain and swelling in a rheumatic joint. The procedure involves removing the inflamed synovial membrane. The scope and complexity of the procedure varies with access and anatomy of the current joint. Access to a multicavity joint such as the wrist, is more difficult, and the chances of radically removing the synovial membrane from all parts of the joint is smaller than in synovectomy of a single cavity joint such as the knee joint, shoulder joint, or a proximal interphalangeal (PIP) joint of the hand. After synovectomy, the operated joint should be immobilized for shortest possible time to avoid stiffness. An exercise program for joint mobility is an important part of treatment. Rehabilitation time is usually at least one month. Arthroscopic synovectomy, mainly in the shoulder and knee, has been introduced as a way to decrease surgical trauma and thereby shorten rehabilitation time.

Arthrosynovectomy can reduce pain and swelling for a considerable time, regardless whether it is performed early or late in the course of disease. Good results have been reported from several centers, mainly in Scandinavia [10,17,18,22]. Several studies have shown that the operation can effectively reduce inflammatory symptoms in a joint, but no scientific evidence shows that synovectomy prevents progressive joint destruction [1,2,5,9,15,21,23]. In recent years, the administration of locally acting cortisone agents to the inflamed joint has partly replaced surgical synovectomy, which now is usually performed concurrently with other interventions in the joint.

Tenosynovectomy (removing an inflamed synovial tendon sheath)

Rheumatic disease may attack the synovial membrane of tendon sheaths, ie, tenosynovitis, in the upper extremities. This usually involves the sheaths of the extention tendons on the back of the hand and/or in the flexion tendons in the wrist, palm, and fingers. Tenosynovitis also occurs frequently in the tendons around the shoulder joint and in the foot, involving the tendons behind the lateral and medial malleolus. Synovitis may involve either the tendon surface or, in some cases, rheumatic nodules may appear within the tendon substance itself. Apart from pain, it often limits the mobility of the attacked tendon. Rheumatic nodules within the tendon itself weakens the tendon substance and may lead to rupture which completely impairs mobility. Tenosynovectomy involves surgically removing the rheumatic, inflamed synovial membrane from tendons and tendon sheaths. Following surgery, patients should receive early, supervised mobility training in the joints involved with the operated tendon. Several daily training sessions with a physical therapist or occupational therapist are included in postsurgical treatment. In some cases, early mobility training may delay wound healing, explaining why rehabilitation may often take 4 to 6 weeks.

Tenosynovectomy is used both as a prophylactic measure to prevent tendon rupture, and as a method to increase mobility and strength. The operation is usually performed in the upper extremities, where the prospects for increased mobility are usually good, although documentation on the prophylactic effects is weak [7,8,11,14,16].

Arthrodesis

The procedure involves removal of remaining joint cartilage from a destroyed, painful joint, so that raw bone surfaces can be affixed to each other using suitable osteosynthesis material (pin, nail, staple, screw, plate) to hold the joint in the correct position while the bone surfaces heal. When the bone surfaces have healed, the osteosynthetic material can be removed if necessary, and the previously mobile but painful joint is replaced with a painfree but stiff "joint". The time needed for bone healing following arthrodesis varies, but is at least 6 weeks in the hand and forefoot, 8 to 12

weeks in the middle foot, and even longer in the ankle and shoulder joints.

The wrist, the metacarpophalangeal (MCP) joint, the distal interphalangeal (DIP) joints, the ankle joint, middle foot joints, and the base joint of the great toe are especially suited for arthrodesis since stability and freedom from pain in these joints are more important than mobility. Other joints (the MCP and PIP joints of the fingers, elbow, shoulder, hip, and knee) are less suited. In some cases, surgical correction of the position is also required in an already spontaneously rigid joint or in an arthrodesis-stabilized joint.

A special type of arthrodesis is that which involves the base of the skull and the first and second cervical vertebra. An attempt is made to achieve bone healing between the vertebral arches and not in the actual joint junctions. Healing usually requires 10 to 12 weeks.

Soft-tissue surgery

Typical deformities of the hand caused by rheumatoid arthritis are ulnar drift (tendency for the fingers to be angled toward the little finger, shoemakers' thumb (the thumb is in a flexed position in the MCP joint and overextended in the IP joint), boutonnière deformity (malalignment in the finger joints similar to that in shoemakers' thumb), and swan-neck deformity (overextension of the fingers in the PIP joint and a flexed position in the DIP joint). When the joint is radiologically intact, deformities such as those listed above may be counteracted or corrected by transferring tendons (centralization of extensor tendons or tendon transfer), or strengthening weakened ligaments. The procedures usually require immobilization (days to weeks) after which mobility exercises are required.

For good results after soft-tissue corrections, the joints involved should reveal very little or no destruction on radiological examination.

Soft-tissue intervention around the hip and knee is rarely performed as an isolated procedure. Even severe malalignment may be corrected by soft-tissue surgery in association with arthroplasty.

Arthroplasty (reconstruction of destroyed joints)

Destroyed joints that cause malalignment, poor mobility, and/or pain, may need to be replaced by artificial joints (arthroplasty by endoprosthesis) or endogenous material (interposition-arthroplasty). The most frequent reconstructive procedure is arthroplasty by endoprosthesis. Resection arthroplasty with or without interposition of replacement material, may be performed in the shoulder, elbow, wrist, and in the base joints of the fingers and toes. In some cases, a joint-like replacement may be created in the hand and wrist by means of connective tissue plates, tendons, or other endogenous tissue in the proximity of the joint. Interposition arthroplasty works best in the upper extremities, which bear less weight. The advantages of using endogenous material are lower cost and longer life span.

Arthroplasty by endoprosthesis has dominated in the hip, knee, shoulder, and elbow. In the long run, one or both prosthetic components are always subject to wear and deterioration in fixation. There is a risk for prosthetic loosening, and the life span of all artificial joint implants is limited.

Neurolysis

Synovitis in joints and tendon sheaths, or pronounced deformity, may cause nerve trunks in the region to be exposed to increased tissue pressure and/or compression towards bone edges. This may cause functional impairment (compression neuropathy) in the nerve. Symptoms initially include pain and numbness in the innervation area of the nerve (stimulation symptoms). Eventually, there is a loss in function involving decreased sensation in the skin and decreased muscle strength (neurological deficit). Surgical dissection of the current nerve trunk (neurolysis) decreases tissue pressure and may eliminate the symptoms. Neurolysis should be performed at an early stage, before neurological deficit has occurred.

Other

Osteotomy (cutting through long bones) is mainly performed in the bones of the foot and less commonly near the hip or knee.

Ruptured tendons, especially in the hand region, can be reconstructed using different types of tendon reconstruction procedures (tendon transfer, free tendon transplants).

Removal of rheumatic nodules (painful subcu-

taneous nodules) can be performed on both cosmetic and pain indications. Nodules near the elbow and on the gripping surfaces of the fingers may affect the function of the arm/hand, and nodules on the sole of the foot may cause pronounced gait problems.

Indications

Life-threatening cervical spine instability, impending tendon rupture, and peripheral nerve compression are definitely indications for surgery. Other indications are relative.

Surgical treatment may interfere with the disease process in various ways. Some surgical interventions aim at decreasing the amount of actively inflammatory synovial membrane, others aim at correcting deformity caused by the rheumatic destruction, and yet others aim at replacing destroyed joints or tendons. The indications may be classified under one of the following categories:

- Pain relief
- Prophylaxis (preventing deterioration)
- Reconstruction of deformity and/or joint instability involving lost function
- Cosmetics

Pain relief is the most common indication, since aches and pain are the main problems facing rheumatic patients and usually what brings them to a physician. The decision of whether or not a painful joint in a rheumatic patient requires surgery must be based on analyzing the cause of pain. Joint pain may result from synovitis in a non-destroyed joint, from joint destruction, instability, or malalignment without evident inflammation, or from a combination of synovitis and joint destruction. The indication for surgery and choice of surgical method is obviously strongly affected by these factors. If radiology shows the joint to be well preserved, usually one should await the results of optimal non-surgical interventions. However, if there are structural changes in the joint, medication cannot be expected to be sufficient. Surgery should be considered if assistive walking devices and orthoses are not effective in reducing pressure.

Procedures aimed at stabilizing the cervical spine (preventing spinal cord injury), removing inflammatory tissue from joints or tendon sheaths (preventing cartilage tissue destruction and tendon rupture), and procedures to remove sharp, protruding bone edges (which may injure adjacent tissue) are considered to have prophylactic effects. Arthrodesis and correction of deformities of the ankle joint/foot may also prevent unfavorable pressure in the lower extremity. Reconstruction of function usually involves replacing destroyed joints with artificial material (implants) or endogenous tissue, but may also involve arthrodesis of destroyed joints, eg, to improve the load on the foot or the grip of the hand. Procedures that correct severe deformities and rheumatoid nodules are of cosmetic benefit.

Many surgical procedures are performed on interactive indications. A rheumatic hand with bent fingers resulting from painful, stiff knuckle joints can be operated by implantation of joint prostheses. This usually achieves pain relief, and improves function and appearance. A similar result is obtained when, eg, a crooked, impaired, painful knee joint is replaced by a prosthesis.

When determining the indications for surgery and selecting possible surgical methods, the natural course of the disease must also be considered. This may differ among joints and among patients. From a surgical perspective, Simmen has defined three different types of rheumatic destruction which influence both the indications for surgery and the choice of procedure [20]:

- *Type I:* Progressive joint destruction with moderate load- and mobility-related pain, and possibly painfree ankylosis (stiffness).
- *Type II:* Progressive joint destruction with pronounced load- and mobility-related pain where spontaneous ankylosis does not occur.
- *Type III:* Progressive joint destruction with pronounced instability and/or malalignment.

In type I, the patient is usually troubled very little by inflammatory symptoms, while the affected joint may cause problems such as mobility- and load-related pain. When the joint has become completely stiff (ankylosis), joint pain usually disappears. This progression may be beneficial in joints where mobility is less important than stability, eg, in the wrist, the MCP joint of the thumb, and in the joints of the middle foot. Surgical intervention is usually aimed at accelerating the natu-

ral course, eg, to use arthrodesis to achieve an earlier stage what the disease itself would cause over a longer period of time. In mobility-promoting operations, such as implanting joint prostheses (arthroplasty) or removing inflammatory tissue around tendons (tenosynovectomy), the range of motion is usually poorer in joints with this type of rheumatic disease compared to unstable "loose" joints in type III.

In type II, the joint cartilage in the affected joints is gradually destroyed (secondary arthrosis), resulting in mobility- and load-related pain. The affected joints cause pronounced pain and do not become stiff as in type I, but the ability to move with pain remains for some time. In these joints (eg, thumb, PIP, ankle, middle foot) arthrodesis may also be indicated. Mobility-promoting surgery (arthroplasty) shows somewhat better results here than in type I, but worse results than type III. Arthroplasty yields reliably good results in large joints (hip, knee, shoulder, elbow).

Type III joints show a gradual destruction in all the components of the joint (articular capsule, ligaments, articular surfaces), causing instability and malalignment. The patients usually have synovitis in joints and tendon sheaths, accompanied by pronounced pain. Arthroplasty often yields very good results in this group of patients.

Radiological findings in the joint considered for surgical treatment affect the indications and selection of surgical method, as well as assessment of the postoperative results. Radiologically visible joint destruction may be graded in different ways, usually based on the system described by Larsen-Dale-Eek [13].

Contraindications

The surgical risks related to chronic inflammatory joint disease should always be considered when the indication for surgery is assessed:

- susceptibility for infection
- nutritional problems
- cardiovascular problems (vasculitis, valvulitis)
- renal insufficiency (amyloidosis)
- deterioration in bone quality (osteopenia)

Certain medications also increase the risks in surgery:

- Steroids (risk of infection, decreased wound healing, adrenal cortex insufficiency)
- NSAID (tendency to bleed, kidney damage)
- penicillamine (impaired wound healing)
- chemotherapy (bone marrow suppression, susceptibility to infection).

Many agents with analgesic and anti-inflammatory effects increase the tendency to bleed, which in some cases may affect the outcome of surgery. Chemotherapy in rheumatoid arthritis is becoming increasingly common, but knowledge of how these agents affect the healing process is insufficient. Old age and other medical risk factors, active polyarthritis, lack of motivation, or unrealistic patient expectations may suggest that the patient should be persuaded to accept functional impairment rather than to undergo a complicated and potentially hazardous operation.

Postoperative rehabilitation

The significance of postoperative treatment by physical and occupational therapists is insufficiently studied, except for hand surgery procedures. Prospective, controlled randomized trials are lacking. Nevertheless, the experience of every rheumatologist and surgeon specialized in rheumatic procedures shows that active participation by the patient and physical therapist/occupational therapist in postoperative training improves the outcome of surgery by increasing muscular strength and mobility.

Careful instructions to patients on protecting operated joints, and affected, non-operated joints (education in joint protection) is another important aspect of care.

Postoperative complications

Disease-related anemia increases the need for blood transfusions and requires that greater attention be given to pre-and postoperative hemoglobin values.

The risk for postoperative complications is higher in patients with inflammatory joint disease. Wound healing problems are the most common local complication. Untreated, a superficial wound

infection may lead to a deep infection, especially in prosthetic surgery, and requires aggressive and often early surgical treatment. Local pressure from bandages, casts, or bedding easily causes pressure sores, and osteopenia increases the risk for peroperative and postoperative fracture. Adrenal cortex insufficiency due to insufficient cortisone protection is another general complication.

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