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The Swedish Orthopaedic Society held its meeting on September 10–12, 1986, in Östersund, which is situated on a large lake in central Sweden. This year, Östersund celebrated its bicentennial; but more than 1,000 years ago the Vikings had a center here to worship their gods, as well as a fortress on the neighboring island of Frösö. Today, Östersund is the gateway to Sweden's most popular winter recreational area. Östersund has a single hospital that serves 135,000 inhabitants living in a 50,000 square kilometer catchment area. Finally, the meeting gathered 220 Swedish orthopedic surgeons.

The Östersund Orthopedic Clinic, headed by Helge Semb, has, apart from the treatment of ski injuries, become renowned for its rheumatoid surgery. The latter topic was manifested by the invited speaker Professor Norbert Gschwend, Zürich, Switzerland, whose talk was titled "Surgery in rheumatoid arthritis," and which was followed by papers on the subject. In addition, a special symposium entitled "Orthopedics – does it give cost benefit?" was held, and is reflected in the abstracts printed here. Further, the symposium included a debate in which the panel also consisted of health care administrators and politicians under the moderation of Erland Lysell, President of the Swedish Orthopedic Society. Other topics and contributions of this well-organized meeting are evident from the abstracts below. Finally, three greatly appreciated video tapes on orthopedic emergency care were presented by Jan Sandegård, Östersund.

Cost benefit in orthopedics

Treatment costs for fractures of the proximal femur

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In Gothenburg, Sweden, the number of hip fractures increased from 104 in 1940 to 978 in 1985. This increase is partially the result of an increasing proportion of elderly people in the population, but the major part of the increased incidence is not explainable by age factors alone.

The mean length of orthopedic clinical care has decreased from an average of 50 days in the 1950s to 30 days in 1965, 31 days in 1975 and to 15.5 days in 1985. A new rehabilitation program was partially responsible for the decrease in care time during the 1980s.

Average treatment cost for hip fracture patients was 29,300 Swedish kronor in 1985, whereas the total cost for all 978 fracture patients treated in Gothenburg was 28.6 million Swedish kronor in 1985. Reoperations in 18 per cent of the fractures with arthroplasty, along with other types of reoperations, increased the annual treatment cost by 4.7 million Swedish kronor in 1985.

A comparison of the costs for treatment of hip fractures from 1950 to 1985 with respect to 1985 prices results in an effective cost savings (excluding reoperations) of 25.5 million Swedish kronor during the 1950s, 22.1 million Swedish kronor in 1970, 34.5 million Swedish kronor in 1975, 35.8 million Swedish kronor in 1981, and 28.6 million Swedish kronor in 1985.

Thus, productivity has increased four times during the last 30 years owing to better treatment facilities and rehabilitation programs, but our study indicates that an increased monetary demand has been put on orthopedic resources by the hip-fracture patients during the last few decades.

Evaluation of medical technology of femoral neck fracture

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Shrinking economic resources of the health sector along with a steadily increasing number of femoral neck fractures, which is the largest inpatient diagnosis in orthopedic departments, necessitates evaluation of the technology used for treatment.

Three subprocesses of this technology were assessed: choice of osteosynthesis (OS) method, experience of the surgeon, and rehabilitation form for the patient.

Totally, 2,251 patients from Stockholm County were included in the study; all of them were admitted from their own home and all of them were treated by OS. Four types of OS were used: von Bahr, Rydell, Nyström, and Thornton. Physicians in training were compared with specialists as regards the outcome of the OS; also the different attitude to rehabilitation of the patients in institutions versus in their own homes was compared. Mean bed days (MBD) was used as a measurement.

The lowest early complication rate occurred after Rydell OS (18%) and the highest after Thornton OS (34%). Every second fracture operated on by a physician in training developed complications compared with 30 per cent for specialists. Great differences regarding the use of institutional rehabilitation was found between various hospitals, ranging from 48 to 83 per cent.

The consumption of MBD due to primary and necessary reoperations was 98 days after Thornton OS and 65 days after Rydell OS. Also, the MBD consumption was doubled when less experienced physicians operated on the patients compared with specialists. The hospitals that used institutions for rehabilitation of the majority of the patients utilized, on an average, four times as many MBD as those hospitals that rehabilitated their patients at home.

In conclusion, evaluation of medical technology for treating femoral neck fracture will improve the quality of treatment and save bed days in the wake of the growing incidence of this fracture provided health authorities adjust to the results.

Consumption of resources with different treatment programs for femoral neck fracture

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Hip fractures constitute the most resource-consuming group in orthopedics due to occupancy of hospital beds. The treatment programs, including optimized operative procedures, mobilization, and rehabilitation, will influence this consumption. To analyze the situation in different areas, the rehabilitation of patients with femoral neck fracture from Stockholm and Lund were compared. Of the patients, 79 per cent were admitted from their own home in the Stockholm area, whereas in Lund 62 per cent came from their own home and 25 per cent from old peoples' homes. The majority of the patients had returned to their prefracture habitat within 6 months in Stockholm, many using geriatric hospitals for secondary rehabilitation after leaving the acute hospital. Great differences between various centers were found. Patients treated in general surgical units stayed longer in the acute hospital and utilized more secondary rehabilitation resources than those treated in orthopedic units.

In the Lund area the majority of the patients had returned directly from the acute hospital to their prefracture habitat within 2 months after the fracture. All of these hip fractures were uniformly treated at an orthopedic department with standardized treatment procedures and a rapid rehabilitation program.

Using the average day cost for the different treatment levels, the costs can be calculated. Also, the cost for home help and for old peoples's homes were determined and included in the comparison. If a cervical hip fracture could be treated in Stockholm with the same program as in Lund, 36,000 Swedish kronor would be saved for each such fracture during the first 4 months after the fracture. Just above 1,000 cervical hip fractures occur each year in the Stockholm area. Thus, the economic consequences of applying standardized optimized treatments schemes for this resource-consuming type of fracture is obvious.

Cost analysis of arthrosis of the hip

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Treatment of arthrosis of the hip with arthroplasty generally leads to a dramatic improvement of the patient's everyday life with relief of pain and better function of the hip joint. Consequently, the need of analgesics and assistance in the activities of daily life from people close to the patient is diminished.

One hundred and five persons have been questioned before and at least 6 months after having hip arthroplasty as regards pain at rest and on walking, walking ability, and the amount of assistance called for by a hip disease. The economic costs concerning these handicaps have been analyzed. The total costs for the operation and the hospital care needed have been calculated for 40 of these patients, who were randomly selected.

Results. The greatest differences between the situation before and after the operation concern the amount

of pain, walking ability, and the consumption of analgesics.

Before the operation, 90 per cent of the patients had pain on walking compared with 20 per cent after the operation. Seventy per cent had pain at rest compared with 10 per cent after the operation. Fifty-four per cent had a walking distance without a cane exceeding 1 kilometer compared with 14 per cent before the operation. Eighty-four per cent took analgesics before the operation and 18 per cent afterwards. Fifty per cent were assisted in everyday activities by the person with whom they lived with before the operation compared with 25 per cent after the operation.

Cost analysis. The average cost for analgesics before operation was 2.64 Swedish kronor (SEK)/day, after the operation 0.41 SEK/day - saving 813.9 SEK/year. Medical service (doctors' fees) were 1,200 SEK/year before the operation and 300 SEK/year after the operation - a savings of 900 SEK. Community service, including transportation for a few of the patients who had that type of assistance, 48 SEK/day, was after the operation 21.20 SEK/day - a savings 8,833 SEK/year. Fifty per cent of the patients had 1 to 4 hours' assistance in daily life, fulfilled by the person they lived with or by relatives or neighbors. One hour's cost paid for by the community would have been 138.60 SEK/day, amounting to a little more than 50,000 SEK/year.

The operation, including preoperative and postoperative care, amounted to 36,190 SEK. Patients with complications required and received more expensive hospital care. These costs have been calculated as an addition for risks and amount to 4,740 SEK/patient. The total amount for the operation performed therefore is 40,930 SEK.

What is the optimal expenditure for infection prophylaxis in total hip replacements?

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Deep infection after total hip replacement (THR) is a serious complication. This paper presents an evaluation of the efficiency of different methods for prophylaxis in relation to its cost.

Method. All primary THRs and since 1978 all revision procedures in Sweden were recorded. From this material enclosing more than 68,000 THRs, the infection rate was calculated. All the orthopedic departments in Sweden answered a questionnaire on the routines for infection prophylaxis. The cost of each prophylactic method, as well as the reoperation due to infection, was calculated. Loss of quality of life for the infected patient was estimated in money by standards applied by Swedish authorities in traffic planning. On the basis of this information, the cost of all the prophylaxis applied was calculated.

Results. The optimal expenditure for infection prophylaxis, disregarding the quality of life, was achieved when the infection rate was 0.7–0.8 per cent. Systemic antibiotics or Gentamycin mixed in bone cement resulted in this infection rate level. Regardless of the prophylactic method applied, an infection rate below 0.5 per cent was not achieved in this nonselected material. Depending on the annual number of THRs performed at each department, the less expensive expenditure to the 0.5 per cent level was achieved by using a combination of systemic antibiotics and Gentamycin cement or by ultraclean air in combination with systemic antibiotics.

Conclusion. The expenditure for infection prophylaxis in THR can be calculated and an optimum cost depending on the number of THRs performed annually can be determined with the presented model. The model can be used for choosing prophylactic methods with predictable results and costs.

An arthroplasty unit – a profitable investment

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Hip arthroplasty is a therapeutic method with very good results. It is of great importance for the quality of life of the individual, but demands considerable resources. This has often led to long waiting lists and a long waiting period for surgery. The same situation applies to knee arthroplasty. In Uppsala the waiting period increased in the 1980s. The pressure of a waiting list for hips and knees comprising about 1,000 planned arthroplasties and often a 5-year waiting period necessitated the establishment of a specialized arthroplasty unit. These patients become increasingly handicapped while waiting for an operation. A direct reflection of this was an increased cost of medical care for the same hip or knee arthroplasty with the same length of hospital stay if a relatively independent patient was compared with one who needed the help of several persons for ADL. The unit received resources corresponding to nine arthroplasties per week. After 6 months the waiting list for hip arthroplasty had decreased from 529 to 304 and the waiting period from 4 years to 1 year. For knee arthroplasties the corresponding reduction was 224 to 184 persons, but the waiting period for cases without

priority was 6 months and for priority cases about 6 weeks. Before establishment of the arthroplasty unit, the mean hospital stay was 17 days, and after 1 year of activity it was 14 days. Among the younger groups with uncomplicated arthroplasties this period was considerably shorter. Thus, a substantial gain in hospital days per arthroplasty was made by investment in this unit. The rate of complications did not increase, and by careful preoperative planning and organization the beds could be maximally utilized. During 52 weeks, 311 hip and 113 knee arthroplasties and 48 other operations were performed. Only 10 patients were discharged without surgery. Following hip arthroplasty, 7 patients could be moved from institutional care to a home environment, and in the knee arthroplasty group the corresponding number was 4.

Experiences from a care program for patients with low back pain (LBP)

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After a decision of SPRI (The Swedish Planning and Rationalization Institute) and the Gothenburg County Council, a specific district of Gothenburg with about 100,000 inhabitants and 15 general practitioners (GPs) was selected.

A clinic for patients with LBP was established as a link between the Department of Orthopedics, Sahlgren Hospital, and the GPs. The purpose of the clinic was to take care of patients referred by GPs as quickly and as adequately as possible. The clinic was also available for consultations and responsible for the furthering of knowledge to the staff of health care centers in the district. The main aim was to increase the intensity of work recovery for LBP patients. In order to evaluate this program, three periods of 6 months each were chosen during the years 1979–1982. The Gothenburg Workman's Compensation Board registered all the patients sick listed for back pain in the specific district during the same time of the year. The data obtained were computerized.

The program gave shorter sick listing, a great economic gain for society, satisfied GPs, and rather satisfied patients with a better knowledge of the continued treatment of the back problem. Special care programs are needed, but not a special LBP clinic! Most of the LBP patients can be taken care of by GPs, but a physical therapist and a backup team should be available at each health center. We suggest that there should also be one orthopedic surgeon at every orthopedic clinic per 100,000 inhabitants available to the GPs half of his working hours at short notice to give advice, take care of referal patients, and contribute to the further education of GPs in orthopedics.

Meniscectomy – change of costs

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Meniscectomy has during recent years increasingly been performed by the transarthroscopic procedure. This factor among others has developed a more rapid postoperative course and less inconvenience for the patient. We have looked at the effect of this technical development from the economic view, considering the cost of the hospital care and the rehabilitation and sick-leave period. The introduction of the transarthroscopic technique at hospital made it possible to adopt the procedure as a policlinical one. The sick-leave period decreased considerably. The total cost for meniscectomy was reduced by about 75 per cent.

Operative or nonoperative treatment of ACL injuries – a cost analysis

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Aims. To study the economic consequences of operative and conservative treatment of isolated or combined ACL injuries.

Material. Seventy-nine consecutive cases treated in Malmö in 1982–1983. Entrance criteria were age over 15 and no previous knee trauma. The diagnosis – a rupture of the anterior cruciate ligament – was established after stability had been tested under anesthesia, and the patients were then randomized to operative or nonoperative treatment. Sixty-five per cent were men in both groups with the same average age of 26 years. The average follow-up time was 13 months (minimum 12 months).

Methods. The number of hospital days, anesthesia hours, visits to the outpatient department, and the length of sick leave was recorded from patients charts. The cost was calculated with the help of an established economic model. Lost production due to sick leave was estimated as average income including social costs for

patients 25–34 years of age. All the costs are in 1985 prices and in Swedish kronor (SEK).

Results. Medical costs including the cost for reconstruction was 11,558 SEK for the operated on group and 7,934 SEK for the nonoperated on group. Lost production was calculated to be 31,954 SEK for the operated on group and 21,678 SEK for the nonoperated on group.

Discussion. Ninety per cent good clinical results are seen following both operative and nonoperative treatment of ACL injuries. Therefore, differences in costs are of interest. The operated on group has 50 per cent higher medical costs mainly due to longer hospitalization. If nonoperative treatment could be performed without examination under anesthesia, the differences would be even greater. If all the ACL injuries were treated operatively or all nonoperatively, the difference in medical cost can be estimated to be 350,000 SEK per 100 ACL injuries. If nonoperative treatment is applied, 1.4 million SEK per 100 ACL injuries can be gained if sick leave benefits and lost production are also taken into account.

A retrospective study of the treatment of 332 cases of fractures of the cervical spine seen economically

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A retrospective study was made in the Stockholm County Council of the treatment of 332 fractures of the cervical spine. Treatment was given with collars (47%), operation (6%), skull traction (24%), and Halo Vest (23%).

The choice of treatment was decided upon according to local practice and degree of displacement. Thus, the nondisplaced and the least displaced fractures were treated with collars. The choice of treatment between operation, skull traction, or Halo vest for the severely displaced fractures was made according to local practice.

When compared with operations and skull traction treatment, the Halo vest treatment gave a low complication rate together with a low number of days spent in hospital beds, sick leave, and disability pensions. Treatment with the collars or Halo vest were 3 to 5 times less expensive than that by operation.

Surgery in rheumatoid arthritis

Cutaneous sensory impairment in rheumatoid atlantoaxial subluxation assessed quantitatively by electrical stimulation

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Sensory symptoms are frequent in rheumatoid patients with atlantoaxial subluxation. The aim of the present study was to explore the degree and the type of sensory impairment in patients with advanced rheumatoid atlantoaxial subluxation.

Material and methods. An electric stimulator with a pulse duration of 0.2 msec and a stimulus frequency of 100 Hz was used. The bipolar electrode, consisting of saline-soaked felt discs, was pressed against the skin bilaterally over the trigeminal, C3–C7, thoracic, lumbar, and S1 dermatomes. The threshold for perception (a weak tingling sensation) and the threshold for pain (slightest discomfort) were measured in 27 patients with rheumatoid arthritis and in 10 patients without rheumatoid disease.

Results. Patients with anterior atlantoaxial subluxation had significantly increased thresholds for perception and pain over the ophthalmic division of the trigeminal nerve. Patients with vertical atlantoaxial subluxation had impaired perception and pain levels over both the ophthalmic and the maxillary division of the trigeminal nerve, as well as over several cervical, thoracic, and lumbar levels. The mandibular division was always saved. The trigeminal sensory impairment seems to come early in rheumatoid patients with atlantoaxial subluxation and progress with the severity of the subluxation, possibly due to bony compression of the trigeminal spinal tract at the C1 level.

Humeral head cup arthroplasty in rheumatoid arthritis

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Cup hemiarthroplasty of the humeral head, using a stainless steel hemispheric cup, was performed in 26 shoulders of patients with rheumatoid arthritis who had severe pain and loss of function. All the shoulders were

Larsen's radiographic grade 4 or 5. Follow-up ranged between 6 and 54 months (mean 22 months) and included assessments of pain, ADL function, and the radiographic features of the joint.

Twenty-two joints were painless. Function improved in all the patients. Radiolucent zones were seen in 3 cases, 1 of which had residual pain. One joint with impingement was reoperated on successfully. The remaining three joints with residual pain in 1985 were painless at recent follow-up.

In the few joints with severe destruction of the humeral head, a stemmed prosthesis is preferable. Further follow-up is required.

Long-term results of total hip replacement in ankylosing spondylitis

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In 1977, we reported on 10 patients with ankylosing spondylitis who had THR in 18 hips (*Acta Orthop. Scand.*, 48:499–507). The mean observation time was 3.8 years. The mean age at operation was 32 years. Reduced range of motion was the main indication for surgery. We have now taken a "second look" 9 years later to determine the function of these hips. The patients were relatively young and active; they had usually very restricted lumbar motion; and we calculated great stress on the prosthesis with risk of loosening. Three patients (with five operated on hips) had died, leaving 7 patients with 13 operated on hips for follow-up.

Result. In one hip there was a perforation of a loose acetabular tip into the pelvis with pain, and the patient was reoperated on 13 years after the first THR.

In a second patient the femoral prosthesis is loose 12 years after surgery (scalloping and distal migration), but the patient has so far refused proposed reoperation on the basis of good function and very little pain.

Eleven hips were clinically good and showed no signs of loosening.

Shoulder pain in rheumatoid arthritis

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The aim of the study was to analyze the prevalence and severeness of shoulder pain in a population of patients with rheumatoid arthritis.

Material. Totally, 105 patients (26 men and 79 women) with classic or definite rheumatoid arthritis (RA) were included. The mean age of the patients was 62 years and the average duration of their RA was 17 years.

The clinical examination concentrated on shoulder swelling, tenderness, and mobility. In all, 116 shoulders in 61 patients were examined radiographically and classified according to the Larsen–Dale–Eek system.

Results. Nine patients had never experienced any shoulder pain and they had normal shoulder function. The remainder, 96 patients (91%) reported shoulder problems, most of them bilaterally. Fifteen patients had slight, occasional pain. Forty-eight patients had intermittent, moderate pain, whereas 33 patients had severe painful shoulder disability. Sixty-five patients had been treated with intraarticular cortison injections. Subacromial swelling was recorded in 22 shoulders and the acromioclavicular joint was tender in 36 shoulders. With increasing duration of the RA, there was clinically a decrease in shoulder function and radiologically a progression of destructive changes of the glenohumeral and acromioclavicular joints.

Conclusion. There is a high prevalence of shoulder disability in patients with RA that increases in severity with duration of disease. There is little evidence that conservative treatment can reverse or considerably influence the destructive process in the rheumatoid shoulder.

Surgery for rheumatic diseases at Östersund's Hospital 1980–1985

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During the period 1980–1985, totally 655 operations were performed. Of those operated on, 312 (73%) were women and 117 (27%) were men. They were all inpatients at Östersund's Hospital for Rheumatic Diseases.

A total of 42 different types of rheumatic surgery have been recorded. Almost half of the operations (273, 42%) were performed during 1984 and 1985.

Complications following surgery were kept at a low level, due, among other things, to early, active rehabilitation. The most common postsurgical complication was deep venous thrombosis of the lower leg, followed by wound infection and paralysis of the peroneal nerve. None of the complications gave rise to permanent disability.

Late synovectomy with resection of the radial head in the rheumatoid elbow

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Material and methods. Twenty-four consecutively operated on elbows in 20 patients (18 women and 2 men) were followed up by inquiry.

The main indication for operation was pain, often associated with decreased mobility. All the elbows were radiographically classified as Stages III–V according to Larsen. The approach was lateral and if necessary also medial. "Housecleaning" was performed with resection of the radial head and of irregularities of the bone ends and with thorough synovectomy. No interpositum was used. The observation period was 2.5 (1–7) years.

Results. At the follow-up, 21 elbows were reported as being improved – 13 of these considerably improved. Only three elbows had deteriorated. The answers regarding pain, mobility, and strength are recorded in this table.

	improved	impaired
pain	21	2
mobility	21	0
strength	17	2

Nine elbows were judged as stable, 11 somewhat stable, and 2 as very unstable.

Conclusion. Late "housecleaning" with resection of the radial head and thorough synovectomy is very often worthwhile in the rheumatoid elbow. Considerable relief of pain is achieved, as well as improved mobility of functional importance. The elbows are experienced as stronger and problems of instability are few. The operation can be regarded as less hazardous than prosthetic replacement and with the remaining "line of secondary defense."

Occupational orthopedics

Relationship between labor and gonarthrosis

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The prevalence of primary gonarthrosis in 332 men aged about 66 years who all had been doing heavy work for more than 30 years was examined. Only subjects who had presented with symptoms including a knee radiograph were included. Using the criteria of Ahlbäck, the prevalence of primary gonarthrosis was 3.9 per cent in the laborers. In the age-matched internal and external controls, the prevalence was 1.4 per cent and 1.6 percent, respectively. We conclude that there is a coincidence between heavy work and gonarthrosis.

Neck and shoulder complaints among seamstresses

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One hundred and ninety-nine seamstresses at four textile factories in the western part of Sweden were compared with a control group comprising 280 working women in Linköping in the eastern part of Sweden about general health conditions and neck and shoulder complaints. One hundred and thirty-one seamstresses and 119 controls participated in a clinical examination. The incidence of neck and shoulder complaints was significantly higher among seamstresses (75%) compared with the controls (54%). The seamstresses had a higher frequency of objective signs and longer duration of symptoms.

Diagnoses, like tension neck syndrome and humeral tendinitis, were significantly more frequent among seamstresses, whereas background variables for tension syndromes (headache, sleeping problems, etc.) were of the same frequency in both groups. Degenerative diagnoses, such as cervical syndrome and acromioclavicular syndrome, were found in almost the same frequency. In 48 per cent of the seamstresses and in 64 per cent of the control subjects, we had no diagnosis.

Acromioplasty for chronic shoulder pain: A retrospective study

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Totally, 49 operations on 47 patients were performed on the indication chronic shoulder pain not improved by conservative treatment. Subacromial impingement was

demonstrated in all the cases. Anterior acromioplasty according to Neer was used. A special rehabilitation program was given during the first 6 weeks. Records and an extensive questionnaire were used for the follow-up. The material was analyzed in terms of previous conservative treatment, sick leave, grade and type of pain, surgical and radiographic findings, and the patient's own evaluation. The average time of the follow-up was 1 year.

The results were classified into four subgroups. Thirty-two patients were satisfied with the result and were asymptomatic (12 cases=group I) or had no significant pain (20 cases=group II). In 17 cases the patients were not satisfied with the outcome of the operation, and except for 3 of these (=group III), which were slightly improved, they all retained their preoperative symptoms (group IV). All but 10 patients could return to their earlier occupations.

Tears of the cuff were observed in 10 cases without preference for any subgroup, although major tears were found more often in group IV. Preoperatively, 46 patients had pain on shoulder movement and 37 patients had continuous pain at rest. Daily analgesics were consumed by 25 patients, mostly in group IV. The pain reduction postoperatively was most obvious with respect to night pain and continuous pain at rest.

In groups II and III, almost all the patients had a persisting reduction in muscle strength after surgery. A functionally reduced shoulder movement was found in 13 cases out of 23 in these groups.

The average duration of symptoms was 3.5 years and those on sick leave 11 months before and 6 months after surgery, being longest in group IV.

The overall results were considered satisfactory. The patients in group IV with no improvement probably represent a more advanced stage of subacromial impingement.

Why are certain forest machine operators healthy?

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In this study, attention has been focused on the healthy forest machine operators in a matched paired comparison with equally experienced operators having subjective and objective indications of shoulder-neck disorders.

Subjects and methods. Each group consisted of 15 operators: "healthy group" (F group) and "unhealthy group" (S group). They were both put through a three-stage test involving laboratory tests, work methods evaluation in the field, and EMC field studies. Laboratory tests consisted of a fitness test, measurements of neck and shoulder mobility, the strength of shoulder muscles and joints and of elbow muscles and hands. Coordination ability was measured using a fine-muscle coordination test, as well as a test for general body coordination and balance. The interviews of work motivation and sociopsychological well-being at and off work were based on standardized interview forms. Productivity during the previous 5 years was analyzed and compared.

Results. Better rotational mobility was noted in the F group, which also exhibited greater suppleness in the shoulder joints. This difference disappeared when 1 of the test participants who had pain when flexing was eliminated from the comparison. The F group was in all essential aspects stronger than the S group when comparing shoulder-region strength and the combined strength of elbow muscles. The difference was still evident after the pain-suffering test participant had been eliminated from the comparison. The members of both groups had the same production capacity per hour during the previous 5 years. However, the S group had a somewhat lower total production because of absences due to illness. The survey can be seen as a pilot study which at the same time refines some of the survey models. The statistically ascertained differences between the groups with regard to strength measurements, working methods, fine-muscle coordination, sociophysiologic well-being, and productivity results should provide suggestions for complementing the training of machine operators and foremen, as well as for postillness rehabilitation. Further valuable information should be available when the fine-muscle coordination and body coordination tests are further refined and when a more comprehensive sociopsychologic inventory is developed.

A model for assessment and rehabilitation of patients suffering form neck, shoulder, and low back pain

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Pain originating from the spine, including the surrounding muscles in the spinal region, shoulder, and pelvis area, is the most common reason for sick leave in the industrialized nations.

This condition occurs most often in men and women during their active working age. Neck and shoulder pain in particular is most common among women and has increased substantially. The cost for the community is

considerable. The problems can be summarized accordingly: 1) Lack of knowledge concerning the anatomic and physiologic source of pain; 2) Lack of objective methods to measure the level of pain and handicap; 3) Lack of knowledge concerning treatment methods; and 4) Lack of organization in current back-care treatment programs. All of the above are areas for research and development.

Due to the shortage of orthopedic surgeons in Sweden, many patients experience extended periods of sick leave. This inactivation period often results in additional psychologic and social problems.

Cooperation between the orthopedic surgeon, primary physician, and the National Health Insurance Company in early intervention, assessment, and rehabilitation is essential. Psychologic and social evaluations should also be included. Clinical research concerning assessment of diagnostic methods and psychometric tests should be encouraged, as well as close cooperation between the different authorities. Physiotherapeutic and psychologic methods of treatment should be assessed.

Arthroplasties

Ten-year follow-up of the Charnley total hip arthroplasty

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Methods. During the years 1972–1975, the authors performed 149 Charnley total hip replacements in 133 patients (76 women and 57 men) with a mean age of 64 (24–87) years. The diagnosis was coxarthrosis in 111, posttraumatic conditions in 21, rheumatoid arthritis in 13, and failed hemiprosthesis in four joints. Surgery was performed in a conventional theater, with conventional surgical clothing and with penicillin as prophylaxis against infection. During the years 1982–1985, the patients were subjected to a 10-year follow-up, with a mean observation time of 10 (9–11) years.

Results. Thirty-seven patients (28%) with 38 prostheses were dead, 2 of whom had been reoperated on because of deep infection (1/149; 0.7%) and traumatic dislocation, respectively. Six patients (4%) with seven prostheses did not consent to a follow-up examination because of illness, 1 of whom had been reoperated on because of a mechanical loosening after a femur fracture. Of the remaining 104 prostheses, six had been exchanged owing to mechanical stem loosening, which means a total revision rate of 9/149 prostheses (6%). The remaining 98 prostheses in 86 patients were subjected to a radiographic and clinical examination.

Seventy-seven prostheses (78.6%) had normal radiography; 16 prostheses (16.3%) had a subsidence of the stem; four prostheses (4.1%) had a loose stem; one prosthesis had a socket migration; and two prostheses had a socket wear of 2–3 mm.

Of the 16 patients with a subsidence of the stem prosthesis, 7 had sustained at least one hip trauma during the observation period. Eleven patients were totally asymptomatic, 4 had mild and 1 patient had moderate symptoms. Altogether, 89 of the 98 prostheses (91%) gave no clinical symptoms at all.

Conclusions. The 10-year results recorded should probably have been better with an up-to-date cementing technique. The Charnley hip prosthesis holds a strong position in our therapeutic armamentarium, and all the more because the long-term results of uncemented hip prostheses are still unknown.

Müller total hip replacement – a comparative study of the straight and curved Müller stem

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From January 1979 through September 1980, 152 total hip replacements were performed. The patients were randomly operated on and received either a curved or a straight femoral stem Müller prosthesis. The two groups were comparable according to age, operated on side, and diagnosis. Also according to pain, walking ability, and range of motion, the two groups were comparable preoperatively.

At follow-up examination (minimally 5 years), there were equally good results in the two groups according to pain, walking ability, and range of motion. No differences of radiolucent zones above 1 mm could be found on the acetabular side. However, on the femoral side, radiolucent zones above 1 mm were twice as frequent in the curved-stem group as in the straight-stem group.

Migration of the acetabular component more than 5 mm was seen in 4 per cent in each group. Sinking of the femoral components was more frequent in the curved-stem group compared with the straight-stem group. In the straight-stem group, four revisions were performed (5.3%) compared with five (6.6%) in the curved-stem group.

Two different types of femoral prostheses have been compared. Both prostheses gave clinically equal, and excellent, results with a revision frequency of 5.3 and 6.6 per cent over a 5-year follow-up period. However,

radiographically, there were some differences: 1) femoral sinking was more frequent with the curved femoral stem, whereas 2) radiolucent zones were also more frequent and wider with the curved femoral stem. Thus, radiographic loosening was found to be more frequent in the curved-stem group.

Histologic study of periarticular tissue surrounding the Christiansen THR

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During the late 1970s, more than 5,000 Christiansen total hip replacements were implanted in Sweden. Today, about 1,300 of them have been revised, in most of the cases because of aseptic loosening. During the revision operation, severely worn sockets are often found; the joints are often filled with debris material. Bone resorption is often present.

This investigation included conventional light microscopy and transmission electron microscopy of the regenerated synovial membrane and the bone-cement interface in specimens retrieved at revision operations of Christiansen THR. The intraarticular debris contained necrotic fibrinoid material; the same type of material also covered the synovial membrane. With polarizing light, worn plastic particles from the socket were found in the detached intraarticular debris masses, as well as intracellularly and extracellularly in the joint capsule. The microscopic findings were similar to those demonstrated by Willert et al. (1974) in their studies of tissues surrounding the Weber polyester prosthesis. Transmission electron microscopy demonstrated multiple large multinucleated activated macrophages. The cytoplasm of the macrophages was filled with vacuoles surrounded by Delrin particles.

This investigation suggests socket wear with a subsequent tissue reaction including bone resorption as a major mechanism in loosening of the Christiansen total hip replacement.

Total hip replacement and deep-vein thrombosis – relationship to the fibrinolytic system

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Reduced fibrinolytic activity increases the risk of recurrent thromboembolism and it has been suggested that it also plays a role in postoperative thrombosis.

Material and methods. Fibrinolytic parameters were analyzed in 29 patients who underwent total hip replacement. Dextran 70 was given as thrombosis prophylaxis. Blood samples were taken preoperatively, 1 day and 1 week postoperatively. A venous occlusion test was performed in all the patients. 125 I-fibrinogen test was used in deep-vein thrombosis screening. A positive test was confirmed with phlebography. Fibrinolytic activity was measured on fibrin plates. Tissue plasminogen activator (*t*-PA) and its specific inhibitor (PAI) were analyzed with spectrophotometric and immunologic methods.

Results. On the first postoperative day, *t*-PA activity decreased and *t*-PA inhibitor increased significantly; *t*-PA antigen showed no difference. One week postoperatively, only *t*-PA inhibitor showed significant differences from preoperative values. Ten of the patients developed deep-vein thrombosis. *t*-PA inhibitor level in thrombosis patients increased considerably the first postoperative day. This difference was significant compared with nonthrombotic patients both 1 day and 1 week postoperatively.

		Preop.		1 day postop.		1 week postop.	
		DVT	No DVT	DVT	No DVT	DVT	No DVT
t-PA activity IU/ml	Mean	0.54	0.67	0.28	0.24	0.45	0.47
	SD	0.32	0.34	0.22	0.20	0.27	0.31
t-PA inhibitor IU/ml	Mean	7.6	4.0	20.7*	12.1	16.0**	5.2
	SD	4.3	4.1	8.6	8.0	11.9	4.1

Conclusion. The recently discovered *t*-PA inhibitor (PAI) seems to be correlated with postoperative thrombosis in total hip surgery.

Necrosis of the femoral head in pregnancy

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Osteonecrosis of the femoral head is rare in pregnancy. Eleven women are described in whom symptoms developed during pregnancy or soon after delivery. Symptoms were hip pain on weight-bearing or movement with hip stiffness. There were six left hips and five right hips affected. All the patients had radiographic changes consistent with osteonecrosis, and in six collapse of the femoral head was seen. Five women underwent radio-

isotope bone scanning, which showed increased isotope uptake in the affected hip. In two cases a bone biopsy revealed osteonecrosis.

No predisposing factor for the development of osteonecrosis apart from pregnancy could be identified. None of the women took any medication during pregnancy and 7 had never used oral contraceptives. There was no history of vascular disease in any patient.

The condition caused total destruction of the femoral head in 1 woman over a 10-month period. Three women have developed severe arthrosis in the affected joint 5–10 years after the pregnancy, complete remission has occurred in 2 patients, whereas radiographic evidence of hip disease (patchy sclerosis and cyst formation) remains in 5 women.

Unicondylar arthroplasty according to Marmor in gonarthrosis

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Forty patients (mean age 73 years, 26 women with 30 knees and 14 men with 17 knees) were operated on, owing to arthrosis, according to Marmor by replacing mainly the medial condyle. Hospital care was usually less than 2 weeks. No case of deep infection was noted.

A follow-up was carried out by the author 1.5–7 years after the operation. Thirty-nine of the patients were satisfied or very satisfied with the result of the operation, whereas 5 were doubtful and 3 patients were dissatisfied. Most of the patients have been able to take up physical activities such as cycling and forest-trekking.

Freeman-Samuelson cementless knee arthroplasty

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In a prospective and longitudinal study, cementless fixation of tricompartmental knee arthroplasty was evaluated clinically and radiographically.

Material and method. Totally, 138 knee arthroplasties were operated on in 123 patients. Twenty-six patients were men and 97 women. The diagnosis was rheumatoid arthritis in 58 per cent and arthrosis in 42 per cent. The mean age in RA was 60 years and in arthrosis 70 years. Follow-up took place at 6 months and thereafter yearly according to a standardized protocol including radiographs.

Results. Pain at rest and during motion was present preoperatively in all the knees. Postoperatively, 3 patients had slight pain at rest and 29 patients had slight pain during motion, moderate in three knees and severe in one knee.

In addition, 101 knees had a valgus deformity of 5–50 degrees preoperatively and 74 knees had a varus deformity between 5 and 30 degrees. Postoperatively, there was no valgus or varus deformity exceeding 10 degrees. Flexion was postoperatively 90 degrees or more in all the knees except one. The majority had a flexion between 100 and 110 degrees. The ability to walk improved dramatically.

Early complications were present in 17 knees: peroneal palsy in 7, delayed wound healing in 6, thrombosis in 3 patients, and pulmonary embolism in 1 patient. All early complications resolved after treatment. Late complications were deep infection in 1 case and septic loosening in another. Both were revised successfully.

Hospital for Special Surgery Score revealed an excellent result in 53 per cent, good in 35 per cent, fair in 9 per cent, and poor in 3 per cent. The number of good and excellent results remained unchanged at 1-, 2-, and 3-year follow-up examinations.

The radiographic evaluation showed a very accurate immediate postoperative positioning of the components. A change in the position of the tibial component was noted in 23 knees on the lateral view, as well as in the frontal view. Twelve components tilted 3 degrees, 7 tilted 4 degrees, and 4 titled 5 degrees in the AP view. Bone sclerosis around the plastic pegs in the tibia was present to a varying degree in 67 per cent medially and 76% laterally.

Conclusion. Cementless prosthetic fixation using plastic pegs gave a good result over a short period of time. The fixation of the femoral and patellar components was good in all the cases. The fixation of the tibial component is still a problem, and sinkage was present in some knees. RA knees tilted more than arthrotic knees, and those patients had an inferior clinical result according to the HSS score. Improved fixation of the tibial component can be achieved in elderly and osteoporotic patients by using cement.

Bone morphology in the proximal tibia in arthrosis and rheumatoid arthritis

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Bone biopsies were taken from the proximal medial aspect of the tibia during total knee arthroplasty in patients suffering from arthrosis and rheumatoid arthritis. Ten arthrosis cases and 10 rheumatoid arthritis cases were included. The biopsy site was 0.5–1 cm below the joint line, i.e., the level at which the tibial component was placed. The biopsies were studied in an ordinary light microscope.

With one exception (arthrosis) the biopsies showed no signs of chronic inflammation in the periosteal connective tissue or in the marrow tissue. The marrow tissue in all the cases was an inactive, fatty marrow. The difference between arthrosis and RA was in the texture of the bone; in arthrosis the trabecular pattern was dense and regular, whereas in RA the trabeculae were slender and widely spaced. There was active remodeling of the bone in both arthrosis and RA.

From a histologic point of view, the difference in bone morphology between arthrosis and RA is more of a quantitative than qualitative nature. Whether or not this implies a similar pattern of bone healing after, for instance, prosthetic joint replacement, requires further study.

Imaging applications

Ultrasonic investigation of the anatomy in neonatal hip instability

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The anatomy of 80 hip joints of newborn infants was evaluated with an anterior ultrasonic approach. Video technique was used for recording and evaluation of the investigations, which included provocation for detection of instability. The size of the femoral head and the acetabulum, the coverage of the femoral head, the acetabular depth and the anteroposterior inclination of the acetabulum were measured and related to the actual degree of instability.

Statistical analysis detected a high reliability of the measurements performed. No significant differences of the anatomic measurements were found between stable and unstable hip joints.

Ultrasonic evaluation of physical examination for neonatal hip instability

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The accuracy of physical examination for detecting neonatal hip instability was evaluated with ultrasound. The ultrasonic examination was performed with the transducer in the groin and the child in the "frog position." The stability of the joint was determined during provocation according to Barlow.

Two consecutive studies were performed, one of 109 healthy newborns (age <1 day) and another of 108 infants (age <1 month) admitted by pediatricians for suspected hip instability.

The physical examination was found to be highly inaccurate, with a vast overdetection of hip instability. Further, the physical investigator could fail to detect gross instability and dislocation.

The indication for treatment was based solely on the ultrasonic diagnosis. At follow-up at 1 and 3 months of age, respectively, all the infants presented stable and normally developed hip joints.

In conclusion, physical evaluation for detecting neonatal hip instability is an inaccurate method compared with a dynamic ultrasonic examination of the joint.

Evaluation of popliteal masses by sonography

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Sonographic examination of the popliteal space was performed in 28 patients with a history of a popliteal mass. Ultimate diagnosis was achieved by aspiration biopsy or surgery. Twenty-one patients showed a clearly defined structure corresponding to the physical examination. Sixteen patients had an echo-free thin-walled cystic lesion diagnosed as a popliteal cyst. Mixed cystic-solid lesions were found in 2 patients, and the diagnoses were popliteal cyst with a loose body and soft-tissue sarcoma with a hematoma. Three patients showed solid lesions, and the subsequent diagnosis was muscle rupture, lipoma, and soft-tissue sarcoma.

Sonography is an excellent noninvasive method for evaluating popliteal masses. Sonographic evidence of a thin-walled cystic lesion is conclusive for a benign cyst. Mixed cystic-solid nature of the mass, especially with irregularities of the wall, as well as solid tumor, should always be investigated further to exclude malignancy.

Functional lumbar myelography in chronic radicular syndromes

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The discrepancy between symptoms and radiographic findings in neurogenic claudication is distressing. The radicular symptoms are caused by structures encroaching into the spinal canal and the root sleeves in flexion-extension movements. The root compression is hardly demonstrated in the resting position. More often radiculography in flexion and extension gives satisfactory information, but still this information is not very physiologic. We have tried to perform the lumbar myelography in a more functional way. For 25 patients with neurogenic claudication, the computed tomography did not present any disc herniation. During the standard radiculography, pictures were also taken with the patient in the standing position bending sideways and backwards. In 11 of the 25 examinations, this simple procedure was found to add essential information. The main restriction to the procedure was pain itself, making it difficult for the patient to carry through the provocation maneuvers. Pain symptoms sometimes were very clearly reproduced in the disc distension test and the myelographic pictures completed by the simultaneous discography.

Microsurgical lumbar root decompression

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The advantages of microsurgical technique in spinal surgery is well known. Up to now, however, it has not been widely used by orthopedic surgeons in Sweden. Based on a spinal rehabilitation program, we have now practiced the technique for 2 years. Our experience is that of a remarkable decrease in postoperative morbidity. This means a shortening of inpatient care from over 1 week to 4 days. The patient is able to attend the physical training program already after 3 weeks. As a result, sick leave has decreased by one third. The microscope has proved to be an essential tool also in decompression of lateral spinal stenosis.

Pigmented villonodular synovitis of the hip joint

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Pigmented villonodular synovitis (PVNS) is a benign proliferative process of the synovial membrane with a potential for local recurrence. The knee joint is most commonly affected and arthroscopy is an aid in diagnosis.

When the hip joint is affected, pain and limitation of motion are the only clinical findings, whereas radiographic signs of erosive bone lesions are common. The bone changes, equally common on the acetabular and the femoral side, are mostly cystic radiolucent defects with a thin sclerotic rim 1–2 cm in diameter and sometimes lobulated. The cysts may be localized at some distance from the joint line even in the distal part of the femoral neck.

The diagnosis of PVNS of the hip joint is often delayed resulting in secondary arthrosis and sometimes considerable destruction of the joint.

Two patients with PVNS and progressive destruction of the hip joint during conservative treatment for suspected arthrosis were described.

In young patients with hip pain of unknown origin, arthroscopy with synovial biopsy is recommended. Aspiration of the joint and cytologic analysis of the joint fluid can also be helpful in establishing the correct diagnosis. Knowledge of the typical radiographic findings might result in a shorter delay between onset of symptoms and correct diagnosis and treatment.

Hip fractures

Methods of osteosynthesis in cervical and trochanteric femoral fractures in Sweden in 1985

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Material and methods. A questionnaire was sent to all the 90 hospital departments in Sweden that perform hip

fracture operations; answers were obtained from every department. A comparison was made with our previous study from 1982.

Results. Cervical fractures. Osteosynthesis with a single nail was used at 16 departments, hook-pinning at 21, two von Bahr screws at 47, and multiple pinning at 31 departments. In comparison with our study from 1982, single nailing as the method of choice has decreased and hook-pinning has increased (Table 1).

Trochanteric fractures. Osteosynthesis with different types of sliding screw and plate was used at 70 out of 90 departments, whereas Ender-nailing has decreased in favor of the sliding screw and plate.

Table 1. Methods used as a percentage of the number of cervical hip fractures 1982/1985:

multiple pins	18/23
von Bahr screws	37/39
hook-pins	7/22
single nail	34/11
various	4/5

Table 2. Methods used as a percentage of number of trochanteric fractures 1982/1985:

sliding screw and plate	34/49
Ender-nailing	60/46
various	6/5

Implant-induced dislocation of femoral neck osteotomies: A biomechanical study in human cadaver hips

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Osteosynthesis with four fixation instruments – hook-pin, Gouffon screw, four-flanged nail, and sliding hip screw – was performed on human cadaveric femora after femoral neck osteotomy.

With a lever a static force was applied through the acetabulum to the osteotomy site in order to prevent dislocation during the osteosynthesis procedure. Motion at the osteotomy site was measured by two strain gauges. The compression force necessary to inhibit motion of the osteotomy site was measured. This force was insignificantly lower with a hook-pin than with the other devices.

During surgery of 12 patients with dislocated femoral neck fracture, measurements were made of the forces holding the fracture surfaces together. At the time of osteosynthesis, the leg traction was removed and osteosynthesis was performed using a sliding hip screw and a side plate. A sterilized dynamometer was used to apply a pressure on the barrel guide of the lag screw. Counterforce was provided with a hook around the femoral shaft. The force at which a visible widening of the fracture gap was noted on fluoroscopy was recorded. In 7 of 12 patients, the compression force was (mean±SD) 110±44 N. In the remaining patients the fracture gap did not open up when pressures of up to 200 NB was applied.

These forces were always above the hook-pin forces measured in vitro, but often below the forces obtained with the other devices. Osteosynthesis with the hook pin appears to be the safest method of fixation with little risk of dislocating the fracture during osteosynthesis.

Prognostic yield of femoral bone blood supply in patients with femoral neck fractures

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The uptake of ^{113m}In-transferrin was studied in 103 patients with femoral neck fractures. Femoral bone biopsies and blood samples were obtained during operation. Activity values for bone biopsies and serum were determined, and the uptake ratio between bone and serum was calculated. The activity ratio, Garden classification, the delay between fracture and operation, the patients' age and sex were all compared with radiographic findings, conventional bone scintigraphy, and the clinical outcome. The activity ratio of the femoral head differed significantly between the Garden groups ($P<0.01$). The highest ratios were found in Garden types I and II, whereas the lowest ratios were obtained in Garden III and IV. The activity ratio, as well as the Garden type, predicted the postoperative radiographic finding ($P<0.05$ and $P=0.05$, respectively), but not the clinical yield, i.e., the need for a secondary arthroplasty. This study shows that the blood supply to the femoral head at the time of operation cannot be used for determining whether primary osteosynthesis or arthroplasty should be performed.

Hook-pin fixation in femoral neck fractures. A two-year follow up of 300 cases

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Hook-pin femoral neck fracture fixation has in a prospective randomized study been shown to give signifi-

cantly fewer healing complications than fracture fixation with a 4-flanged nail. Because of this, hook-pins have been used for every case of femoral neck fracture in Lund since 1983. This presentation reflects the 2-year results of hook-pin fixation in femoral neck fractures in a large patient material.

Patients. Totally, 305 consecutive patients with femoral neck fractures were treated at our department from October 1980 through April 1983. The patients were aged 78 (18–98) years and the ratio of females to males was 2.6:1. In five patients, follow-up is missing.

Methods. Hook-pin femoral neck fracture fixation was performed within a few days from fracture by one of 6 surgeons. Full weight bearing was allowed from the first postoperative day except for displaced fractures in patients below 50 years of age; these were prescribed non-weight bearing for 6 weeks. Clinical and radiographic follow-up was performed 1 week, 4, 12, and 24 months after surgery.

Results. Sixty-one of 64 patients with undisplaced fractures, still alive at 2 years from surgery, showed an uncomplicated healing course. Two had developed segmental femoral head collapse and one nonunion; all 3 were reoperated on with total hip arthroplasty. At 2 years, 152 patients with displaced fractures were alive. Thirty-nine of these had developed redisplacement/ nonunion and 14 segmental femoral head collapse. Thirty-one had been reoperated on with total hip arthroplasty. Eighty-four patients (28%) died within 2 years of the operation. No perioperative mortality and no deep infections were seen.

Conclusion. In a prospective 2-year follow-up of femoral neck fractures operated on with hook-pins, a 28 per cent mortality was noted. Nineteen per cent of the original material had developed radiographic complications (25 per cent of displaced and 5 per cent of undisplaced fractures), whereas a secondary hip arthroplasty had been performed in 11 per cent (15 per cent of survivors). Referring to these figures, the authors recommend atraumatic osteosynthesis as primary treatment of femoral neck fractures.

Evaluation of the bipolar Bateman endoprosthesis for femoral neck fractures

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During a 2-year period from April 1982, 93 arthroplasties in 91 patients (mean age 76 years) were performed with the Bateman bipolar hip endoprosthesis with a Moore stem.

In 57 patients the indication was a subcapital, totally dislocated or irreducible fracture or a fracture redislocation within 3 months (early operation).

In 36 patients the indication was pseudarthrosis, avascular necrosis of the femoral head (without signs of acetabular erosion) or pathologic fracture with at least 3 months' duration of symptoms (late operation).

Posterolateral approach was used and seven prostheses were cemented. The overall mortality was 15 per cent; in patients operated on early the mortality was 18 per cent within 6 months. Local complications were dislocation in 4 patients and infection in 4. There were 18 reoperations in 12 patients; four attempts at closed reduction, which all failed; five extractions of the prosthesis (including the four dislocations); seven THRs and two prostheses (once cemented) were explored.

Clinical and radiographic examinations were performed every half year. At 18–48 months' follow-up (mean=24), 68 hips were available for examination. Thirty-eight per cent of the patients were dissatisfied. Clinically, 20 patients had pain on weight bearing, 17 pain at rest, 26 could not walk without at least two canes, and 52 could walk less than an hour (even slowly with a cane). The range of motion was less than 160 degrees in 19 hips. The two groups only differed in the use of walking aids with a significantly increased use among patients operated on early.

The postoperative radiographic analysis showed lengthening (> 5 mm) in 49 per cent, cup smaller than the contralateral head in 23 per cent, and varus position (>2 degrees) in 22 per cent.

At the follow-up examination a radiolucency around the stem of at least 2 mm in at least 4 out of 7 zones was recorded in 38 per cent; subsidence of the prosthesis (>5 mm) in 47 per cent; acetabular erosion (>3 mm) in 26 per cent; and pronounced paraarticular bone formation in 17 per cent.

There was no correlation between acetabular erosion and clinical problems. The only positive correlation between radiographic findings and clinical results was a significantly increased incidence of pain on weight bearing when both acetabular erosion and radiolucency were present.

In conclusion, hemiarthroplasty with a Bateman prosthesis in this study led to 1) a high mortality in early operations, 2) a high frequency of reoperations, 3) a high frequently of poor clinical results, and 4) a high frequency of acetabular erosion. This study has not provided any evidence of a superiority of this bipolar design over the traditional hemiprosthetic concept.

Hemiarthroplasty with uncemented soft-top bipolar endoprosthesis after femoral neck fractures

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The bipolar soft-top endoprosthesis is a single unit consisting of a stainless steel femoral component with the head enclosed in a high-density polyethylene cup. If a well-fitting head is selected, the cup must not act as a wearing surface within the acetabulum, and thus protect the acetabular cartilage from wear.

Over the last 9 years, 202 arthroplasties using the soft-top bipolar hemiarthroplasties have been performed at our department after femoral neck fractures. The mean age of the patients was 77 (48–92) years. There were 158 women and 44 men.

The indication for operation was pseudarthrosis in 72 patients, segmental collapse of the femoral head in 40, and early fracture dislocation in 49 patients. In 41 patients the arthroplasty was performed as a primary procedure.

The patients were prospectively followed with yearly radiographic and clinical assessment. The follow-up was 5 (1–9) years. Eighty per cent of the patients were classified as excellent or good, according to d'Aubigné and Postel, and 20 per cent as fair or poor, when pain was evaluated.

Twenty-two patients were reoperated on, 9 with total hip prosthesis and 13 with Girdlestone.

Wear of the polyethylene cup with foreign body reaction and massive scalloping was seen in 13 patients. All of these except 2 were classified as poor. Of these patients, 5 sustained proximal femoral fractures around or below the femoral component.

We conclude that the overall results are satisfactory, and the low incidence of failures reflects the advantage of the bipolar prosthesis. We warn against the use of this type of prosthesis in patients with rheumatoid arthritis, arthrosis, and long-standing necrosis of the femoral head with affection of the acetabulum. Because of problems with wear of the polyethylene cup, we now use the hard-top design.

Protocol for operation report of hip fracture and hip arthroplasty

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Background. Nonformalized operating reports on hip fractures and hip arthroplasties take a considerable amount of time to typewrite. The content is of varying quality and usually states too little or too much, but often not the relevant information.

Retrospective studies based on nonformalized operating reports are practically impossible to perform. Therefore, a formalized model has been produced.

Method. Data are marked on a form classified as a part of the patient's record. On the form, which is signed by the operating surgeon, there is also space reserved for additional information if necessary.

Outcome. The formalized model has been tested at our department during 1 year and was found easy to handle. The secretary's time for typewriting has been reduced on an average from about 5 to 1 minute in hip fractures and from about 10 to 2 minutes in hip arthroplasties. The operating report now contains all the data that are considered adequate.

Conclusion. The tested form makes an optimal recording of adequate data possible and reduces the secretary's typewriting time by about 80 per cent. The saved time may well be used for computer storage of the data.

Ankle fractures

Operative treatment of pronation injuries of the ankle

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Introduction. Pronation ankle injuries are usually serious. Most units treat these lesions by open reduction and internal fixation. There has been no previous report on the Wiberg-Cedell operative method used for pronation injuries.

Material and methods. Between 1970 and 1976, 99 pronation injuries were treated with surgery according to Wiberg-Cedell in Lund. Plaster was used for 6–8 weeks. A follow-up study was made on all 64 patients (45 men and 19 women) where preoperative and postoperative radiographs were available. Age at operation was 36 (15–80) years. The average observation time was 7 years. Early complications were two infections, one skin necrosis, and one thrombosis.

Results. Clinical examinations showed 49 patients with good results, 9 fair, and 3 poor (3 patients missing). Reduction at operation according to the immediate

postoperative radiographs was anatomic in 47 patients, slight displacement in 16, and 1 patient had more pronounced displacement. The fracture position at follow-up was anatomic in 49 patients and 14 patients showed slight displacement and 1 had a major displacement. The frequency of arthrosis was none in 48 patients, slight joint space reduction in 10, joint space about half normal in 4 patients, and the joint space absent in 2 patients.

Conclusion. After 7 years we have found good clinical and radiographic results in 4 out of 5 patients with pronation injuries to the ankle treated with staples, pins, and cerclage wires.

Joint congruence and stability in ankle fractures operated on with cerclage, pins, and syndesmosis staple

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Methods. During 1979–1983, 196 ankle fractures were operated on with cerclage, pins, and syndesmosis staple at our department. Radiographs taken preoperatively, immediately postoperatively, and after removal of the plaster have been examined. Additional information has been collected from the patients' case records. Based on this information the fractures have been graded according to Lauge Hansen, and the reduction of the fractures has been graded according to Cedell.

Results. Fractures of type SE Stage IV were the most common ones and comprised nearly half of the injuries (49%), thereafter, SE Stage II (22%) and PE Stage IV (15%). After removal of the plaster, 84 per cent of the SE II injuries, 81 per cent of the SE III injuries, and 70 per cent of the SE IV injuries showed an anatomic (e.g., exact) position, whereas the corresponding figure for the PE IV injuries was 55 per cent. Anatomic or good reduction was seen in totally 85 per cent of the supination injuries and in 71 per cent of the pronation injuries.

Secondary displacement has not been observed in any of the fractures. One patient (0.5%) has been reoperated on because of an inferior reduction. Complications have been scarce; the most serious ones were in 4 patients who had deep infection (2%) that resulted in arthrosis. However, no systematic long-term follow-up of the patients has been made and the incidence of arthrosis is probably higher.

Conclusions. The results indicate that osteosynthesis with cerclage, pins, and syndesmosis staple give a good joint congruence and stability in ankle fractures and that these injuries heal without any secondary displacement.

Kinematic analysis of the ankle mobility and stability

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The mechanical stability of the ankle joint in patients with chronic lateral instability has previously been investigated with conventional radiography.

We have studied the stability of the ankle joint with roentgen stereophotogrammetric analysis. The rotatory movements of the talus between plantar and dorsal flexion was registered. Sagittal instability (anterior drawer sign) was investigated with loads up to 160 N and talar tilt was registered at a maximum torque of 8 Nm.

The material included 33 ankles – 9 without and 24 with symptoms of lateral instability and frequent distorsions.

The mean talar tilt was 4.3 degrees in the group without symptoms and 9.5 degrees in the group with symptoms. A slight difference of the sagittal stability at a load of 40 N was registered (ankles without symptoms: 0.8 mm, and ankles with symptoms: 3.8 mm). Increasing the sagittal load to 160 N resulted in a smaller difference between the two groups.

Symmetric distribution of the sagittal stability at greater loads may indicate that other factors than the elasticity of the ankle ligaments could also be of importance regarding the stability of the ankle joint.

Operative treatment of multicomponent ankle fractures

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Several operative techniques for bimalleolar and trimalleolar ankle fractures have been described and several devices for their fixation have been recommended. Because very few actual comparisons have been performed between the various methods, there is still controversy on what technique to advocate. The aim of the present paper is to establish the least tolerable postoperative displacement after bimalleolar and trimalleolar ankle fractures and to compare two commonly

applied techniques of open reduction and internal fixation (ORIF) with regard to this postoperative displacement.

Totally, 134 consecutive patients with bimalleolar and trimalleolar ankle fractures were examined with regard to postoperative displacement and classified accordingly. At follow-up the patients without displacement were significantly better than the patients with displacement. There were only minor differences between those with subtle and grave displacements, respectively.

Two techniques of ORIF were compared in a study of 24 matched pairs. One of the techniques was a nonrigid technique using cerclage wire, staples, smooth pins, and rush pins. The other was a rigid technique using screws and plates. The nonrigid technique showed a significantly higher frequency of postoperative displacements. The conclusions are that no displacement whatsoever is tolerable after ORIF of bimalleolar and trimalleolar ankle fractures and that the rigid technique seems more favourable.

Early or late weight bearing of operated on bimalleolar ankle fractures

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The purpose of this study was to elucidate if immediate postoperative weight bearing in a walking cast can be allowed after operations on dislocated bimalleolar ankle fractures.

Methods. A prospective, randomized investigation with weight bearing from the first postoperative day (n=24) or from the fourth postoperative week (n=29) was performed. A below-the-knee cast was used in both groups for a period of 7 weeks. All the fractures were operated on using cerclage wires, staples, and pins. Clinical and radiographic examinations were performed postoperatively after 3 and 7 weeks and after 3 and 6 months.

Results. No significant differences concerning subjective and objective clinical results between the two groups were found. Exact reconstruction of the ankle mortise could, as a rule, be achieved and fracture stability was sufficient to allow immediate postoperative weight bearing in a walking cast. Several cases of skin irritation and/or superficial wound infection were noticed in the early weight-bearing group.

Conclusion. Early weight bearing after operations on bimalleolar ankle fractures does not cause redisplacement and considerably facilitates rehabilitation.

Cost analysis of supination-eversion stage II (SE II) fractures of the ankle

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Aims. To compare the costs for operative treatment with the costs for conservative treatment of SE II fractures.

Material. All SE II fractures diagnosed and treated in Malmö in 1983–1984 in 126 patients.

Operative group: 46 patients (24 men, 22 women, 37±13 years).

Conservative group: 80 patients (28 men, 52 women, 54±17 years). Forty-five per cent of the SE II fractures were operated on in 1983 and 26 per cent in 1984. All the displaced fractures were operated on initially, but during the period under study there has been a shift towards a more conservative approach.

Methods. The number of days in hospital, anesthesia time, hours in recovery room (RR), visits to the outpatient department (OPD), and the number of radiographs obtained were noted from the patients' records. The costs for these variables were accounted for in an accepted economic model.

Results. The medical costs for operative treatment were 9,613 SEK. For conservative treatment, they were 1,800 SEK. The costs for anesthesia time and consumed hospital days differed the most. To the costs of operative treatment can be added an additional 1,524 SEK for extraction of the osteosynthetic devices.

Discussion. Operative treatment led to more consumption of hospital beds, longer anesthesia and RR times, more OPD visits, and more radiographs in spite of the many elderly patients in the conservatively treated group. However, a comparison of the medical costs can only be of interest when comparing alternatives with equal results. Long-term follow-up of SE II fractures have shown that both operative and conservative treatments give good results. In Malmö the total differences in costs between treating all the SE II fractures operatively or treating them all by conservative means can be estimated at 600,000 SEK annually.

Ligament injuries and fractures

Anatomic reconstruction of the lateral ligaments of the ankle joint: A new procedure

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Ankle ligament injuries are one of the most common injuries to the lower extremity, and may result in chronic instability, a severe disability especially in young or active persons. Several surgical procedures to reconstruct the lateral ligaments of the ankle joint have been described. Tenodeses using the peroneus brevis or longus tendons have been most commonly used, whereas local anatomic reconstructions have been used more seldom. During recent years, we have performed anatomic reconstructions of the lateral ligaments.

Material. Sixty patients have been operated on for chronic instability of the ankle joint. These patients were evaluated 3.5 (2–5) years postoperatively with analysis of function and activity level. Mechanical stability was determined by talar tilt and anterior displacement of the talus on standardized stress radiographs.

Method. The insufficient ligament(s) is divided 1–3 mm from the insertion into the fibula. A subperiosteal dissection releasing the proximal ligamentous insertion is performed. A bone block about 5 mm deep is chiseled off the anterior, inferior fibula border, after which the distal end of the ligament is refixed using mattress sutures through drill channels in the fibula. The proximal end of the ligament including a periosteal flap is duplicated over the distal portion. Both the anterior talofibular and the calcaneofibular ligaments can be reconstructed using the same method.

Results. The functional results were excellent in 48 patients, good in 6, fair in 2, and poor in 4 patients. The patients with unsatisfactory results had either very long-standing ligamentous insufficiency or general joint laxity. One patient has been reoperated on. No serious complications occurred. The objective stability as measured on stress radiographs showed better mechanical stability in patients with excellent or good results than in those with fair or poor results.

Conclusion. The described operative technique is simple and gives good functional results, as well as mechanical stability, when evaluated on standardized stress radiographs in the majority of patients. We feel that this procedure is a good alternative to more complex procedures.

Old partial rupture of the patellar ligament: Results of operative therapy

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The jumper's knee is defined as an overuse syndrome at the level of the insertion of the patellar ligament into the patella. The anatomic lesion has been described as focal degeneration, but microruptures or macroruptures of the ligament at the bone-ligament junction are also responsible.

The lesion is frequently overlooked in the differential diagnosis of anterior knee pain. Operative treatment is indicated if conservative treatment fails to result in an improvement in 6 months.

Several operative procedures have been described, such as excision of the lower patellar pole, release of the ligament from its junction to the patella, or drilling of the patella.

The operation in this study consisted of longitudinal splitting of the patellar ligament with wedge resection of devitalized ligamentous tissue. No bone procedures were performed. Postoperatively, the leg was immobilized in a plaster cast for 4 weeks, allowing weight bearing and isometric quadriceps training. A rehabilitation program was started after 4 weeks and the patients were allowed to take part in sports after 12 weeks within the limit of pain.

During the last 13 years, 35 patients have been operated on for an old partial rupture of the patellar ligament at the orthopedic departments in Gothenburg. Thirty-two of the patients were men and 3 were women. Their average age was 25 (15–51) years, and the average follow-up time was 4 (1–13) years.

The functional results were excellent or good in 31 patients and fair or poor in 4. Of 34 active athletes, 30 were able to return to the preinjury level. No serious complications were seen.

We conclude that excision of the devitalized ligamentous tissue leads to satisfactory functional results in the majority of patients and that more complex surgical procedures are seldom needed.

Evaluation of decreased performance of the quadriceps muscle in chronic symptomatic anterior cruciate ligament insufficiency

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The thigh musculature in 11 patients with chronic symptomatic insufficiency of the anterior cruciate ligament has been studied in an attempt to evaluate why there is a discrepancy between decrease in muscle size and muscle strength. Muscle size was measured by computerized tomography; the excitatory input to the muscle morphology by enzyme histochemistry; and the excitatory input to the muscle by surface electromyography.

The affected limbs showed a mean decrease in quadriceps cross-sectional area of 6.0 per cent, whereas there was a mean increase in hamstring cross-sectional area of 2.6 per cent. Light and electron microscopy disclosed abnormalities, albeit to a very limited extent, in muscle fiber morphology. Among these were alterations in size and shape, changes in subcellular organization and dedifferentiated myofibrillar material. All the strength parameters (maximum torque, work or mean power) were significantly decreased in the injured patients in relation to the noninjured limb by 15.4–30.2 per cent depending on the velocity of angular motion. The ratios of maximum torque and work, but not mean power, divided by quadriceps cross-sectional area were also significantly decreased in the injured limb. The summed integrated surface EMG (iEMG) activity from the vastus medialis, vastus lateralis, and rectus femoris was significantly decreased by 21.3–28.3 per cent depending on the velocity of angular motion. The highest decreases of iEMG activity were observed for the rectus femoris. Significant relationships existed between the relative summed iEMG activity (per cent of the noninjured limb) and relative strength (work and mean power). There was no change of iEMG/work ratio in the injured limb, indicating normally functioning muscle fibers. No relationships between iEMG activity and the severity of symptoms (Lysholm knee score) were found.

Our data suggest that the major strength deficits observed in patients with chronic symptomatic insufficiency of the anterior cruciate ligament are due to reduced motor unit activation and not to hypotrophic or abnormally functioning muscle fibers per se. The data do not support the ideas of highly advanced or selective muscle strength training in these patients.

Clinical accuracy of a new positioning device for reconstruction of the anterior cruciate ligament

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The importance of proper isometric positioning of the anterior cruciate ligament substitute has been pointed out earlier (Odensten & Gillquist 1984). In reconstructing the ACL it is also important to use a reproducible technique for placing the drill channels in the proper position and in proper relationship to each other. To accomplish this, we designed a drill-guide instrumentation based on anatomic measurements.

In 47 patients who underwent reconstruction of the ACL with a Dacron graft, the drill-guide device was used in 30 patients and in 17 patients drilling was done freehand, trying to use anatomic measurements for positioning the substitute. Postoperative radiographs in the lateral projection in flexion and extension made it possible to locate the intraarticular inlets of the drill channels in the tibia and the femur. Their relative locations were plotted in a diagram and compared.

Also, 10 cadaver knees were dissected and the center of the ACL-attachment areas were marked with a metal indicator. The knees were then subject to radiographic investigation and were used as a control.

Results. There were no significant differences in positioning of the tibial attachment with or without the drill-guide or compared with the normal tibial attachment of the ACL in the cadaver knees. However, the variation in positioning of the femoral attachment was greater without the drill-guide than with it ($P<0.001$); and as a rule, the femoral attachment was placed too far forward with freehand drilling when compared with the "drill-guide knees" and the cadaver knees. The femoral ACL attachment of the "drill-guide knees" did not differ from the normal cadaver knees.

Conclusion. With this new drill-guide device a correct anatomic and isometric position of the ACL substitute is possible to achieve in a reproducible way.

Percutaneous wiring of distal tibial fractures

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From March 1979 to February 1985, we treated 24 patients with displaced fractures of the distal tibia with percutaneous wiring. Twenty-two of these patients could be followed. All the fractures healed without

further operations. Two patients showed delayed union (>24 weeks), but were healed within 2 years. Duration of surgery was on an average 30 minutes (15–50 min) including application of the plaster cast. The method appears simple and reliable in suitable cases, and together with a plaster cast provides sufficient stability.

Bilateral measurement of tibial torsion in 100 normal adults

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Introduction. It is generally considered that the tibial torsion in the right and left legs in the same normal adult individual is of the same magnitude. This conclusion is based on measurements with fairly imprecise methods in relatively small materials. A new simple, but precise, method for measuring this torsion has been developed and used in a comparatively large study of bilateral tibial torsion.

Method and material. The C-arm image intensifier is used for the measurement. The tangents of the dorsal contours of the femoral condyles and of the inner surface of the medial malleolus are chosen as the proximal and distal line of reference. The material was a random sample of normal adults with no previous injury to the tibia, knee, or ankle joint. There were 40 men and 60 women, aged 18–61 years.

Results.

A. Tibial torsion:

1. Right tibia: Mean=31.7° SD=7.8°
   Range: 14.4°–50.6°
   Left tibia: Mean=29.6° SD=7.6°
   Range: 11.8°–50.4°

The difference between the right and left tibias was significant ($P<0.05$).

2. Torsion decreased with age. Age groups 15–25 and 45–65 years were tested ($P<0.05$).
3. Correlation with age, whole material:
   Right tibia: Correlation coefficient $r=-0.17$ ($P<0.05$).
   Left tibia: Correlation coefficient $r=-0.24$ ($P<0.05$)

Torsion decreased more with age in men than in women.

B. Bilateral torsion – difference:

1. Whole material: Mean=2.1° (right dominance) SD=5.2° Range: −11.1° to 14.5°. The mean value differed significantly from 0° ($P<.001$).
   Men: Mean=3.1° SD=5.4° Range: −7.1° to 14.5°
   Women: Mean=1.4° SD=4.9° Range: −11.1° to 11.2°
2. Whole material – percentage number of subjects in the range:
   Mean ±2°=30%, mean ±4°=56%, mean ±6°=75%
3. There was no correlation with age.

Conclusion.

1. Rotational deformity in a tibial fracture cannot be ruled out by using the unfractured tibia for comparison.
2. If precise anatomic alignment is the aim, open reduction must be performed.

Gait disturbance after immobilization of one leg

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Persons who have had one leg immobilized in a cast can have a long persisting disturbance of gait after removal of the cast. This gait disturbance occurs despite complete absence of pain and is of such a character that it cannot be explained by restricted joint movements or weakness due to atrophy of disuse.

We studied 6 patients who had had one leg immobilized for various reasons during periods ranging from 3 to 7 weeks. The mean time from removal of the plaster cast until the first examination was 11.5 days. Surprisingly, we found the tendon reflexes to be increased on the previously immobilized side. The threshold of the vibration sense was determined quantitatively in two points in the skin of the soles of the feet by means of an electromagnetic vibrator. The threshold was lowered in the majority of measuring points on the immobilized side in comparison with the corresponding control points. The gait disturbance resembled spastic, atactic, or spastic-atactic gait with one leg. We have given evidence that the "spastic" component of the gait and the increased tendon reflexes are caused by both a peripheral and a central factor. In the periphery an increased stiffness due to altered viscoelastic properties of the muscle spindle-tendon complex would be expected to result in an abnormal influx of impulses from the muscle spindles to the spinal cord on passive stretch of the muscles. We have also demonstrated an increased sensitivity of the synapse of the stretch reflex in the spinal cord. This finding gains support in earlier experimental work in animals.

The atactic component of the gait correlates with the lowered vibration thresholds in the sole of the foot and is probably a central phenomenon. Mechanoreceptors in the sole of the foot project to the cerebellum and subserve a proprioceptive function via the dorsal spinocerebellar tract. It has been shown in animal experiments that immobilization of one leg results in increased synaptic efficiency in this pathway.

We believe that our findings will have consequences for the design of physiotherapeutic methods aiming at a more rapid restoration of normal gait.

Neurologic complications after Colles' fracture: Local anesthesia vs. no anesthesia

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The frequency of neurologic affection in the hand in patients treated for Colles' fracture was evaluated. The results of traditional treatment consisting of injection of a local anesthetic agent into the fracture hematoma and manual reduction were compared with the results after reduction by a new dynamic method where no anesthesia was used.

The material consisted of 116 consecutive patients with displaced Colles' fractures. The study was designed as a prospective, randomized trial. The traditional treatment was used in 54 patients and the new treatment in 62 patients. The two treatment groups were equal with regard to age, sex, fracture type, initial displacement, time between accident and treatment, achieved reduction, and aftercare.

The following variables were used to assess neurologic affections: Subjective: numbness; Objective: two point discrimination over 4 mm, Tinel's sign, Phalen's sign, atrophy of the thenar eminence. If both subjective and objective variables were present, the patient was considered to have a neurologic complication. Any neurologic complication from the accident to the completion of the study (48 months) was recorded.

In the traditionally treated group, 14/54 patients showed neurologic affections as compared with 4/62 in the dynamically reduced group ($P<0.01$). In no case, however, was the neurologic affection of such magnitude that neurolysis had to be performed.

The results of the study support previous reports that local injection of an anesthetic agent into the fracture hematoma is associated with a high frequency of neurologic complications. The procedure also leads to dangerously high tissue pressure in the carpal tunnel. Dynamic reduction is more gentle than traditional manipulation, which also might affect the results of the study.

The new dynamic bone alignment device offers a good alternative to manual manipulation, as no local injection of an anesthetic drug into the fracture hematoma is required. If manual manipulation is preferred other types of anesthesia are advocated.

Morphologic evidence against functional cycles of parathyroid cells

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Parathyroid hormone is the most important modifier of momentary fluctuations of the concentration of ionized calcium in extracellular fluids. Ultrastructurally, parathyroid glands exhibit a marked cellular heterogeneity, the cell profiles, e.g., varying in their contents of endoplasmic reticulum and Golgi bodies, as well as in the tortuosity of plasma membranes. In analogy with the established concept of protein synthesis, these observations have led to the proposal that there are different cell populations of varying metabolic activity or, alternatively, that the individual cells are undergoing repeating cycles, alternating between periods of secretory activity and periods of rest.

In an ultrastructural study on the parathyroids of young rats, including serial sectioning, we have made some observations that challenge the concept of secretory cycles: The parathyroid cells are arranged in a pseudostratified manner forming highly convoluted and branching epithelial sheets. Moreover, the cells exhibit structural polarity: nuclei and lysosomes are mainly located towards interstitial tissue, whereas the Golgi bodies almost always are confined to regions in the interior of the cell sheets. Here, the cell surfaces are tortuous; in contrast, toward the interstitial tissue the plasma membranes are smooth. It is obvious that an ultrathin section, which constitutes about one thousandth of a parathyroid cell, cannot be expected to be a representative sample of an individual cell's morphology. Hence, depending on the level of the histologic section, a cell may appear to be more or less "active." And, because of the arrangement of the cells, a histologic section may hit even adjacent cells at different poles. It is our opinion that these data give a coherent expanation of the well-known ultrastructural variability among secretory parathyroid cells, and our results do not support the concept of functional cycles of parathyroid cells.