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SPINE

Orthopaedic spine surgery—actual costs?

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Orthopaedic spinal surgery has expanded to become one of the most resource-demanding fields in modern hospital treatment, and yet few studies have specifically focused on this. The purpose of this study was to compare the actual to the predicted costs when implementing orthopaedic spinal surgery.

Material and methods: During a 6-month period we prospectively recorded all costs in a consecutive series of a total of 44 patients, subgrouped into the diagnoses: scoliosis ($n=4$), lumbar or lumbosacral instability ($n=23$), acute (8) or sequelae after (2) thoracolumbar fracture, spondylitis (3), or spinal stenosis (4).

We recorded the total costs of treatment in each patient including preoperative evaluation, the hospital-stay (ward, operating theatre, intensive care unit and postoperative physiotherapy), and the postoperative follow-up at the out-patient clinic. The recording included factors such as time consumption, price of implants, blood tests, and products, radiology, and utensils.

Results: The average costs could be predicted for implants (mean 20,406 DKr), length of hospital-stay (mean 12.5 days) and most other factors related to the treatment. On the other hand, some predictions were misjudged by a factor ten e.g. blood-products with an over-estimation of 450,000 DKr.

Conclusion: Orthopaedic spinal surgery is very resource-demanding. Most costs could be predicted with high precision, but others turned out to be much lower than estimated.

Epidural analgesia after thoracolumbar spinal surgery

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Efficient pain control after spinal surgery is important e.g. for patient satisfaction and for early mobilisation. The purpose of this study was to evaluate epidural analgesia after thoracolumbar spinal surgery with special emphasis on complications.

Material and methods: A prospective study comprising 46 consecutive patients who underwent spinal surgery at the above department. Peroperatively the surgeon introduced the delivery system for epidural patient-controlled analgesia with a combination of opioid and bupivacaine.

Results: The treatment was initiated in 80% (37) of the patients. 20% (9) did not have the system established because of infection (2), technical problems (6), or accidental dural perforation (1).

The delivery system was maintained mean 4.5 (0–13) days in the patients treated. 80% of these had an uncomplicated course with efficient pain control allowing early mobilisation. No patients suffered respiratory depression or infection.

The most serious complication occurred in one patient who accidentally had the catheter dislodged too early—this happened in 3 patients all together. Several unsuccessful attempts at re-catheterisation were performed with the newly operated patient sitting in kyphosis. In another patient the pain relief was insufficient probably due to a misplaced catheter and as this was not fully realized at the ICU no alternative pain-treatment was administered.

Conclusion: Epidural anaesthetic infusions in orthopaedic spinal surgery provide excellent postoperative analgesia in the majority of patients with only few and no serious side effects or complications.

Is Scheuermann's disease and the degree of lordosis correlated to low back pain?

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In the clinical examination of a patient with low back pain determination of the size of lumbar lordosis is a crucial

point. Studies have shown a relationship between low Scheuermann's disease and low back pain. The postulated causality is based on clinical examination of patients, whereas the number of population studies concerning similar analyses are few. Purpose was to estimate the relationship between the size of lordosis in the lumbar-spine and Scheuermann's disease and the symptoms of low back pain based on a population study.

Material and methods: 4151 persons, mean age 63 (21–90), living in Østerbro/Copenhagen were selected and they accepted to participate in a physical examination including radiological examination of the thoracolumbar spine in an upright standing-position. The lordosis was measured by Cobb's method. All underwent a detailed interview including registration of symptoms from locomotive apparatus.

Results: The median lordosis was 53 (0–95) degrees.

	No	Lordosis	Lower back pain
Low back pain	2267	↓ (S)	
Former spinal fracture	90	↓ (S)	↑ (S)
Former spinal surgery	148	↓ (NS)	↑ (S)
Scheuermann's dis.	287	↓ (NS)	(NS)
Olisthesis	391	↑ (S)	(NS)

There was no significant correlation between Scheuermann's disease and low back pain or between an olisthesis and low back pain.

A logistic regression analysis with low back pain as a dependent variable and including previous spine surgery previous spine fractures, presence of olisthesis and decreased lordosis was performed.

	Odds ratio
Hypolordosis	1.48 (1.26–1.75)
Former spinal surgery	1.49 (1.70–3.65)
Spinal fracture	2.45 (1.50–4.00)

Conclusion: Hypolordosis in the lumbar spine is correlated with increased frequency of low back pain. Scheuermann's disease in the thoracolumbar region was not correlated to low back pain in a Danish population.

Outcome of Smith-Robinson anterior cervical discectomy and arthrodesis with ORION®-plate

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We evaluated the results of the Smith-Robinson method of anterior cervical discectomy and arthrodesis by means of autogenous iliac-crest bone-graft¹ plus fixation with ORION®-plate, at 1 to 2 levels, in patients who had symptomatic cervical nerve root irritation for different reasons.

Patients and methods: 16 patients, 9 women and 7 men, median age 48 (21–62) years were operated at the Dept. of

Orthopedics, Aarhus Municipal Hospital, between August 1995 and November 1997 for the diagnoses listed in Table 1. A one-level procedure was done in 11 and a two-level procedure in 5 of the 16 patients. The average follow-up time was 5.6 (3–18) months.

Table 1. The diagnoses underlying cervical nerve root irritation in this study, their number and the number of levels affected

Diagnosis	Complete	1 level	2 levels
Cervical intervert. disc degen.	8	4	4
Cervical spine fracture	5	4	1
Cervical disc herniation	1	1	-
Vertebral spine luxation	1	1	-
Spinal canal stenosis	1	1	-

The evaluation of outcome was done on the basis of the patients' clinical data and roentgenographies before operation and at follow-up examinations. Radiographic parameters were healing of the graft, kyphotic angle of the affected segments, height of intervertebral disc, placement of the ORION®-plate and material erosion. The patients subjective outcome was assessed by means of the adapted Oswestry Low Back Pain Disability Questionnaire and the Northwick Park Neck Pain Questionnaire.

Results: The mean hospital stay was 13 (7–32) days. Post-operative complications were one donor site haematoma without infection and a Horner's syndrome of the left eye, which settled after 6 months postoperatively. Symptoms at the time of follow-up are shown in table 2.

Table 2. Symptoms at the time of follow-up

Symptoms	Number
Symptom-free	6
Moderate neck pain	4
Radicular pain	3
Dysphagia	2
Headache	1
Concentration problems	1
"Clicking" impression	1
Limited neck rotation	1

One patient reported a sensation of "clicking" which disappeared after 6 months. The radiographic outcome was satisfying with good placement and healing of plate and graft. Subjectively, 11 patients considered their outcome satisfactory, 2 unsatisfactory and 3 answers are still to be submitted.

Conclusion: Smith-Robinson anterior cervical discectomy and arthrodesis with ORION®-plate is a satisfying procedure for several diseases affecting the cervical nerve root.

Reference: 1. Robinson RA, Smith GW. The treatment of certain spine disorders by anterior removal of the intervertebral disc and interbody fusion. JBJS [AM] 1958; 40: 607–24.

HAND AND SHOULDER

Finger joint arthrodesis with two crossed Kirschner-wires—frequency of complications in a 5 year period

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Many surgical procedures for arthrodesis of the small joints (distal and proximal interphalangeal and metacarpophalangeal joints) are known. Biomechanical measurements of stability of the arthrodesis have shown that two crossed K-wires for fixation are among the most unstable procedures. This procedure, however, is one of the most widely used in Denmark. Because of instability a number of reoperations could be expected.

The aim of this study was to review complications when this procedure was used for arthrodesis in the small finger joints.

Material and methods: From January 1992 to December 1996, 121 arthrodeses in 101 patients were performed using two crossed K-wires for fixation. The study was retrospective, reviewing records.

A questionnaire was sent to departments expected to perform arthrodesis of the small finger joints in Denmark.

Results: 86% of the departments in Denmark performing arthrodesis of the small finger joints used the crossed K-wire technique.

In our department 43 women, 58 men with a mean age of 43 (10–88) years were treated. The indication for primary arthrodesis was trauma (76), arthrosis (3), congenital deformity (1), arthritis (37), Dupuytren (2) and others (2). 30 reoperations (25%) were performed in 17 patients. 19 were re-arthrodeses, 7 amputations and 4 others.

Conclusion: 25% of the primary arthrodeses had to be reoperated. Whether this high number is due to an inferior method has to be further investigated.

Mannerfelt-Malmsteen arthrodesis in the rheumatoid hand

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In 1971 Mannerfelt and Malmsteen published a technique for arthrodesis of the wrist: Dorsal incision, destruction of the radiocarpal joint, retrograde introduction of a Rush-pin through the third metacarpal bone into the radius. Stabilization of the rotation by one or two Wiberg staples. Only three articles have discussed results after this procedure despite the fact that it is a frequently used procedure. Only one of the articles is on the functional outcome.

Material and methods: The method has been used at Hvidovre Hospital from 1979. Until the end of 1996, 24 operations have been performed in 24 RA patients. Minimum fol-

low-up was 12 months. At follow-up a questionnaire with special emphasis on the functional outcome was filled in. Radiographs of both wrist were obtained and a clinical examination of the wrist and the movement of the fingers was performed.

Results: Three activities of daily living were found particularly difficult to perform by a majority of the patients: Handling of jar lids/ bottle caps, handling of tools and handling of coins. Twentytwo of the patients considered the result to be an improvement compared to their preoperative status. Radiographic evaluation showed bony fusion in all but one patient who had a fibrous union. This patient had to be reoperated three times, primarily due to the fact that the IIIrd metacarpal bone fractured during the first operation. Finally fibrous union was accomplished by a dorsal plaster slab for 4 weeks. No Rush pins had loosened and only two Wiberg staples had broken. No postoperative infection was recorded.

Conclusion: Our results confirm that the patients operated by the Mannerfelt-Malmsteen method both objectively and subjectively have a stable, painless wrist enabling them to perform most daily chores in a satisfactory way. Based upon our experiences we feel that this treatment of the painful rheumatoid wrist can be recommended.

Wrist arthrodesis using AO titanium wrist fusion plate

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Patients with a painful, unstable, unbalanced wrist are candidates for wrist arthrodesis. This study reviews early surgical and functional results of 14 wrists which underwent fusion using the AO technique and AO titanium wrist fusion plate.

Material and methods: 10 male and 4 female patients with a median age of 39 (21–70) years were operated between October 1994 and August 1997. Indications for surgery were post-traumatic arthritis in 11 patients (3 scaphoid nonunion, 2 SLAC, 2 perilunate fracture-dislocations, 4 distal radius fractures), monoarthritis in 1, Kienbocks disease in one and tumor in one patient. Cancellous or corticocancellous bone grafts were used from the iliac crest in 7 patients and from the removed local bone in 7 patients. 12 additional procedures were performed at the index surgery. Follow-up averaged 24 (6–40) months. A questionnaire of standard patient review questions, Buck-Gramcko and Lohmann's wrist score were used for functional assessment of patients.

Results: Osseous union was achieved in all patients. 93% of patients were satisfied with the operation. Buck-Gramcko and Lohmann's wrist score was excellent or good in 10, satisfactory in 3 and poor in 1 patient. In 3 patients plate tenderness was relieved by plate removal. One supination-pronation difficulty was treated by excision of the ulnar head.

Conclusion: AO wrist fusion plate and AO technique for

wrist fusion is a good, reliable and predictable method of obtaining fusion for a pain free and stable wrist.

Vibrometry as a diagnostic tool for carpal tunnel syndrome—a prospective study

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Until now the diagnosis of carpal tunnel syndrome (CTS) has been based on patient-history, clinical findings and ENG. Several international studies indicate that vibration testing is more sensitive and less painful for the patient. This study aims to determine the relevance of vibration testing compared to traditional ENG with emphasis on a presumed greater sensitivity.

Material and methods: All patients are selected according to specific inclusion-and exclusion criteria. A primary and a half-year-control examination is performed on each patient including a self-administered questionnaire (severity of symptoms), an objective evaluation (tinel, strength, atrophy, TPD) and a neurophysiological evaluation (vibrometry, ENG). Both operated and non-operated patients undergo the same routine examinations. On the basis of the neurophysiological findings patients are divided into 4 groups:

- A: Abnormal vibrometry, normal ENG.
- B: Abnormal vibrometry, abnormal ENG.
- C: Normal vibrometry, normal ENG.
- D: Normal vibrometry, abnormal ENG.

Normally patients belonging to group B+D are offered an operation and will form our control group. In this study also patients in group A will be offered an operation and they form our investigation group.

Results: 137 hands (87 patients) with subjective complaints associated with CTS have been included in our project. 77 hands have been operated.

- Group A : 30 hands (14 operated).
- Group B+D: 93 hands (60 operated).
- Group C : 14 hands (3 operated).

Conclusion: The final data processing is still in progress. The statistic significance and the use of vibration testing will be discussed. Vibration testing however does not seem capable of replacing the traditional ENG but could be an important supplement.

Endoscopic carpal tunnel release—an evaluation of patient satisfaction correlated to pre- and postoperative function and symptoms (Levine score)

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Levine has described a combined symptom and functional score system for use in evaluating Carpal tunnel syndrome, and the aim of the present study was to evaluate patient satisfaction after endoscopic carpal tunnel release correlated to pre- and postoperative function and symptoms described by the Levine score system.

Material and methods: In a 21-month period we used the Agee one-portal system in 101 hands in 88 patients. There were 68 women and 20 men with a median age of 49 (23–94) years. All patients were operated by one surgeon. The patients were evaluated preoperatively and after 8 weeks using the Levine score system.

Results: There were no nerve lesions or other complications. The median symptom score was reduced from 43 (57–19) to 11 (51–11), and the median function score was reduced from 30 (40–11) to 8 (32–8). Average patient satisfaction after 8 weeks (on a scale from 0–10) was 8.7 (median 10 (10–0)).

Patient satisfaction was correlated to 42 different variables using regression analysis, and the total symptom score of the Levine score at 8 weeks was found to give the best correlation to patient satisfaction followed by the total function score of the Levine score.

Conclusion: In conclusion, we have not experienced any complications in our series, and endoscopic carpal tunnel release had a high degree of patient compliance. The Levine score system correlates well with patient satisfaction and is recommended for pre- and postoperative evaluation of the result of carpal tunnel release in carpal tunnel syndrome.

Wrist arthroscopy—indications and clinical applications

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Arthroscopy of the wrist is a relatively new procedure. Many different indications for diagnosis and therapy have been proposed and the aim of this study was to review the diagnostic and therapeutic use of wrist arthroscopy in our department.

Material and methods: In the period 01.08.97–16.02.98 a total of 30 wrist arthroscopies in 29 patients (21 men and 8 women) were performed by one surgeon. Median age 32.5 (13–87) years. In 26 hands (87%) the symptoms were initiated by trauma.

Results: The most common indication was a possible TFC-lesion (11 cases) followed by fracture sequelae with exostosis (6 cases), a possible carpal instability (5 cases) and arthroscopically assisted osteosynthesis of a distal intra-articular radius fracture (4 cases).

In all patients some intra-articular pathology was found at the arthroscopy. The most common pathology was TFC-lesion (11 cases) followed by chondral lesions (8 cases), synovitis (5 cases) and SL-instability (3 cases).

The most common procedure was resection/suture of the TFC-complex (10 cases) and partial synovectomy/chondrectomy (10 cases) followed by osteosynthesis/transfixation (6 cases).

Apart from one patient with dysaesthesia of the dorsal ulnar-branch there were no complications.

Conclusion: We find, that wrist arthroscopy is a challenging but valuable diagnostic tool in both traumatic and non-traumatic wrist pain. It offers the possibility of various arthroscopically treatment procedures with a low complication rate.

Arthroscopy of the first metacarpophalangeal joint

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Very little information about arthroscopy of the first metacarpophalangeal joint (MCP1) is found in the literature. The purpose of this paper is to describe the technique and to evaluate our initial experiences.

Material and methods: Arthroscopy of the first metacarpophalangeal joint was introduced in our department december 1997, and in the following two months, 9 arthroscopies were performed in 6 women and 3 men. Median age 27 (14–42) years. 7 patients with ligament injuries including 3 with bony avulsions and 2 patients with chronic pain. The setup and technique are described and illustrated.

Results: Visualization of the joint was possible in all cases. The suspected injuries were confirmed. Additional injuries to the volar plate, and the accessory ulnar ligament were seen in 3 cases. One K-wire fixation and one ligament suture were performed. When the torn ligaments were in place or arthroscopic reduction was possible, we treated conservatively. One of the patients with chronic pain (no instability, normal range of motion, normal radiograph, bone scan and MRI) had arthroscopic resection of a displaced partial radial ligament lesion. The second patient with chronic pain had, in my experience, normal arthroscopy. However, radiographic bony changes indicated arthrodesis.

Conclusion: Arthroscopy may be an advantage in evaluating disorders of the MCP1. Arthroscopic treatment is possible in some cases. Our experience with the procedure is limited till now. A thorough knowledge of the normal and pathological anatomy is mandatory.

Magnetic resonance imaging (MRI) for occult scaphoid fractures

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The aim of the study was to evaluate the accuracy of MRI in the diagnosing of occult scaphoid fractures in clinically inapparent cases and to demonstrate additional lesions of the wrist.

Material and methods: From January to March 1997, 20 patients (13 men, 7 women) with clinically suspected scaphoid fractures were included in this prospective study. All 20 patients had sustained a wrist injury and complained about pain at the anatomical snuff box. All were treated in accordance with our usual treatment procedures.

Results:

Type of injury	Radiography	MRI
1) Scaphoid fracture	2	3
2) Distal radius fracture	0	2
3) Fracture of 2. metacarpal bone	1	1
4) Fracture of capitatum	0	1
5) Bone contusion	0	3
6) Soft tissue contusion	0	15
7) Lesion of triangular disc	0	2

Conclusion: In cases of wrist injuries with clinically suspected fracture of the scaphoid MRI is superior to conventional radiography for proper diagnosis. This procedure may prevent patients with simple wrist sprains from being immobilized for weeks and thus save money in our health system.

Lipomas of the forearm and the hand excised by a hand surgical team

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In recent articles no appearance of lipomas in the hands has been described. We present 16 cases of lipomas excised from the forearm and the hand over a period of 20 years.

Material and method: Between 1978 and 1997 our team excised 7 lipomas from the forearm, 1 from the wrist and 8 from the hands; a total of 16 patients (8 men, 8 women); mean age 53 (12–87) years. Time from first appearance of tumor until operation was 2 weeks to 24 years. Three patients had lipomas excised on earlier occasions. Diagnostic MR-scan was performed in 2 cases.

In 9 cases indications for excision were swelling and pain at manual work; six also showed sensibility problems. Three lipomas suddenly began to grow, 1 was suspected of intramuscular growth and another of being adherent to the ulna. Two were excised because of their size.

The work is a retrospective summary of the case notes.

Results: The lipomas varied in size from 2x1x1 cm to 10x5x2 cm; seven were lobular and nine were solid. Eight showed a dissecting growth, one was adherent to the ulna, and one grew intramuscularly. None showed sign of malignancy. Additionally one haemangioma and one neuroma were diagnosed.

No postoperative problems were observed, though one

patient experienced reappearance of tumor. On discharge 2 patients showed unchanged sensibility problems, 4 showed improvement and 8 were fully recovered. No information about the last 2 patients could be found.

Conclusion: Excision of lipomas can cause severe problems for the patient as well as for the surgeon because of their locality, their dissecting growth or their size. Therefore all lipomas except from unquestionably superficial and benign tumors should be excised by a specialist handsurgical team only with easy access to histological diagnosing and possible further treatment.

Bowing fracture of ulna associated with dislocation in the distal radioulnar joint

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Bowing fractures of extremities have previously been described, the first time by Borden in 1974. All presented cases but one have been in children. Usually the bowing fracture in the forearm is associated with cortical fracture in the other bone of the forearm.

We here present a case of bowing fracture of the ulna associated with dislocation of the ulnar head in the distal radioulnar joint.

Materials and methods: A 13-year old girl, who sustained a hyperextensiontrauma of the wrist being a soccer goalkeeper. On the first examination in the emergency ward she was unable to supinate and was found with moderate pain in the wrist. Radioexamination was performed and showed in the lateral view a curved and posteriorly dislocated ulnar bone. Closed reduction was not possible and the ulnar bone was osteotomized and internally fixated. Two months post-operatively she had regained normal function of the forearm.

Conclusion: Bowing fracture of the forearm is a difficult diagnosis and is frequently missed as there is no obvious cortical fracture in the bone in the radiographs. It is essential to examine the mobility of the forearm to uncover this rare kind of fracture.

Neer hemiarthroplasty for displaced humeral head fractures

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Comminuted fractures of the humeral head may be complicated by avascular necrosis. Consequently we have opted for prosthetic replacement in a subgroup of fractures in patients

able to cope with the subsequent rehabilitation.

Material and methods: From 1992 to 1995 a total of 29 patients were treated with cemented Neer hemiarthroplasty for displaced humeral head fractures. 24 cases were four-fragment and 5 were three-fragment fractures. The median age was 75 (54–86) year, 23 were women. Operation was performed median 2 (1–28) days after injury. Physiotherapy was commenced 7 (1–14) days after surgery. No surgical complications were encountered.

25 patients were assessed at follow up 3 (2–5) years after injury, as 4 patients had died. The Constant score was used to assess the clinical outcome. Pain and activity were assessed on a 100 mm VAS and a questionnaire on nine ADL tasks (maximum 27 points). Standard radiographic evaluation was performed.

Results: Median Constant score of the operated shoulder was 52 (17–98) compared to 79 (47–100) of the contralateral shoulder ($p < 0.01$). The median pain score was 15 mm (0–66). The ability to perform ADL amounted to 15 (0–27) points. Delay of operation was adversely related to Constant score ($p < 0.01$), pain ($p < 0.05$) and activity ($p < 0.05$). Postponement of physiotherapy had no impact on outcome. No radiographic signs of loosening were found.

Conclusion: The Neer hemiarthroplasty yields reliable results in the treatment of dislocated humeral head fractures as far as pain and longevity is concerned. The ability to perform activities of daily living and range of movement is severely hampered. Operation should not be unduly delayed.

HIP

A new method for osteosynthesis of intertrochanteric fractures of the femur—Gotfried PC.C.P

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Gotfried PC.C.P, Percutaneous Compression Plating is a new method for treating intertrochanteric fractures using two sliding screws and a compression plate.

The advantages of the method compared to conventional methods should be:

- Percutaneous technique (lesser surgical trauma).
- Preserving the lateral wall of the trochanteric area and thus reducing the risk of deteriorating the nature of the fracture during surgery.
- Provides lateral support to prevent collapse of the fracture before healing has occurred.

We describe the method and present our results in 30 cases.

Material: Two surgeons at the department were trained in using the method by the designer of the system, Dr. Y. Gotfried. 30 patients with intertrochanteric fractures admitted to the department in the late 1997 were treated with the PC.C.P if it was possible for one of the two surgeons to perform the surgery. There were 10 two-fragmentary fractures, 2 three-fragmentary, 8 four-fragmentary and 10 multifragmentary fractures. 11 men and 19 women were included. Median age was 87 (61–95) years. 8 of the 30 patients had died within 6 weeks after fracture, leaving 22 patients for follow-up.

Results: We did not observe any re-displacement of the fractures in the first 22 patients seen at the 6-week follow up. All fractures in patients seen at the 12-week follow-up had healed without displacement. One patient had one screw penetrating the femoral head due to poor positioning during surgery. This patient eventually died of causes not related to the operation. One patient had a soft tissue revision due to hematoma.

Conclusion: We found the Gotfried PC.C.P easy to use and the PC.C.P might have some advantages over other systems for osteosynthesis of intertrochanteric fractures. We find that the Gotfried PC.C.P deserves further investigation.

The Biomet Bi-metric cemented total hip arthroplasty—a five-year minimum follow-up

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Since 1988 our department has used the Biomet Bi-Metric prosthesis as the cemented total hip arthroplasty (THA) of choice. The purpose of this study was to evaluate the clinical and roentgenographic outcome at five years minimum, and to compare two methods of assessing patient functional status compared to signs of radiographic loosening.

Material and methods: The 170 patients treated consecutively from 1988 until 1992 were included. Median age at operation was 74 (41–89), and second generation cementing technique was used. At follow-up, the Harris Hip Score (HHS) was used by SD or AHK to assess clinical status. Independent of this, radiographs were studied by JEM. The patients assessed subjective life distress by answering the Nottingham Health Profile (NHP) questionnaire.

Results: One femoral stem was revised. No cups were revised. 93 THAs were available. Follow-up time was 6.7 (5.3–8.5) years. On the radiographs 1 femoral stem was definitely loose, 3 were probably loose and 29 were possibly loose (Harris et al 1982). One cup was loose. HHS was 86 (27–100). The HHS did not reveal inferior results among the patients with radiographically possible loosening, compared to the rest of the group, whereas the NHP pain section score demonstrated a significant difference ($p=0.03$). The radiographic evaluation was impaired as the immediate postoperative pictures were partly missing.

Conclusion: The intermediate results with the Biomet Bi-Metric cemented THA are satisfactory. Unlike the Harris

Hip Score, the NHP pain section score was significantly worsened in the group of patients with possible radiographic loosening.

Progressive osteolysis after PCA cementless total hip arthroplasty—a 10-year follow-up of 32 cases

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The aim of the present study was to investigate the outcome 10 years after total hip arthroplasty with the cementless porous-coated anatomical (PCA) prosthesis.

Materials and methods: From August 1985 through April 1987, 32 consecutive “first generation” PCA total hip prostheses were implanted in 31 patients. Median age at surgery was 53 years (range 21–65). Preoperative diagnoses were primary coxarthrosis (18), sequelae to a proximal femoral fracture (5), avascular necrosis of the femoral head (4) and miscellaneous (5). Three patients died during the follow-up period. The Harris Hip Score (HHS) was used preoperatively and at each follow-up examination. Roentgenograms were obtained at each visit. Data from three, five, seven and 10 years after surgery were compared to the one year data. Polyethylene wear was measured seven and 10 years after surgery. The Fisher's Exact Test was used to compare data. P -values < 0.05 were considered significant.

Results: Preoperatively, all patients had a poor HHS (median 37, range 9–66). Ten years after surgery, 86% had a good or excellent score (HHS > 79). Progressive changes were observed, in particular severe periprosthetic osteolysis and excessive wear of the polyethylene liner. Significant progressive osteolysis was evident between 1 year and 10 years after surgery ($p=0.00005$), with 86% having osteolysis after 10 years. Wear of the polyethylene, up to 0.4 mm/year, was observed. Wear correlated significantly to severe osteolysis ($p<0.003$), in particular from 5 to 10 years after surgery. 8 patients had been revised or scheduled for revision, mainly due to severe osteolysis in the femur or loosening of the acetabular component. The overall failure-rate 10 years after surgery was 27%.

Conclusion: Implantation of the PCA prosthesis was stopped when the 5-years results were analysed. Data from the 7 and 10 years examinations have confirmed, that this prosthetic design cannot be recommended for implantation, mainly due to massive polyethylene wear and periprosthetic osteolysis.

Anteversion of components in THR

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Most surgeons performing total hip replacements, recommend that both the prosthetic neck and the acetabular cup be placed in 15 degrees anteversion. We aimed to assess the change in ROM by changing component orientation and to determine to what extent the effect on ROM of one component deviating from the optimal, could be remedied by a coherent shift in the position of the other component.

Method: A bone hip model was supplied with a prosthesis and goniometres allowing placing the stem and cup in varying positions. Using a data acquisition system, ROM was established recording all positions in which impingement occurred. 5 combinations of neck/cup anteversion were investigated: 15°/15°; 15°/30°; 00°/30°; 15°/00° and 30°/00°. The cup inclination was kept at 45°.

Graphs were produced, comparing ROM of the optimal 15°/15° position with the deviating positions.

Results and conclusions: The study confirms that anteverting both components 15° provides the most favourable ROM. Deviating from this position however, will not unilaterally reduce ROM: Thus, further anteversion of either component will increase the safe ROM in flexion but decrease ROM in extension. The effect of retroverting the neck or cup is the opposite, i.e. a gain of ROM in extension while ROM is reduced in flexion. Flexion between 80° and 0° for practical purposes, does not involve impingement, regardless of component orientation. It follows that it is indeed possible to improve ROM in cases of incorrect positioning of one of the components by peroperatively adjusting the version of the other component accordingly. However, due to neck/bone and bone/bone impingement, ROM may only be partially restored in this manner.

Postoperative biomechanical evaluation following CAD-based preoperative planning of revision total hip replacements

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Preoperative planning (p.p.) for revision total hip replacements (THR) seems mandatory; especially with grossly migrated components it helps finding the correct lateralisation and height of the pivot point. P.p. also helps to choose implants with a CCD-angle and necklength to reestablish the offset and leglength to avoid unwanted leglength-discrepancies and poor gait. Predicting the implants helps to avoid overreaming of weak bonestock; in some revisions CAD-based p.p. helps to simulate various implants or to construct custom made ones.

Material and methods: A retrospective geometric analysis of pre- and postoperative a.p.-radiographs was done on 100 consecutive revision THR's which were planned and operated by the author between June 1993 and March 1997. The study includes 79 complete revisions, 9 revisions of the stem only, 11 cup revisions and 1 case where a custom built femoral head was replaced.

Results: 1) We achieved a significant improvement of

leglength-discrepancies: Preoperative leglength averaged -14.5 mm, postoperative the shortening was reduced to 3.0 mm; 2) The height of the pivot point was significantly normalized from in average +12.1 mm preoperatively to +3.6 mm postoperatively; 3) Prediction of the exact stem was possible in 85% of the cases; 4) Precise prediction of the cup was possible in 78%; and 5) The rate of postoperative luxations was 2%.

Conclusion: CAD-based p.p. is a helpful device to obtain a good accuracy of the postoperative geometric parameters in revision THR.

Boneloc revisited

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From January 1991 to April 1995 we performed 429 primary Exeter hip arthroplasties with Boneloc cement. Following a 5-year clinical and radiographical follow-up study of our first 129 Boneloc cemented Exeter hips a questionnaire study of the remainder Boneloc patients was answered by 94.5%. This questionnaire study was performed shortly after a very heated and emotionally charged debate about Boneloc in the Danish media so, not surprisingly, the patients' own evaluations were significantly poorer than the former clinical studies. A subsequent clinical, radiographical and scintigraphical examination of some of the most unsatisfied patients showed that most dissatisfaction was due to fear and uncertainty concerning the hip prostheses and not to actual symptoms from the hip. Three to nearly 7 years after implantation only 5 Exeter stems (1.1%) and 9 cups (2.1%) have been revised because of aseptic loosening. With revision for any reason as end point the 7-year cumulative survival of both components was 93%, which compares fairly well with "the gold standard".

Failure of the ACS polyethylene liner with metal-shell penetration and extensive osteolysis

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Disassembly of modular acetabular components and periprosthetic excessive osteolysis are well documented phenomenon when using cementless metal-backed designs. The case report presents an implant failure of the Anatomic Medullary Locking (AML) hip prosthesis using the Acetabular Cup System (ACS).

Material: A 54 year-old man had a right hip replacement for nine years without complications. Radiographs then showed eccentric location of the femoral head, and extensive osteolysis around the acetabulum. The femoral head had worn through the liner and afterwards penetrated the metal-

shell. The ACS polyethylene liner was fractured at the superior rim. Despite massive bone-destruction in the region, the acetabular and femoral components were solidly fixed. Reconstruction was successful with metal nets and extensive bone grafting using the Exeter Exchange technique.

Discussion: Retrospectively, the radiographs performed five years earlier were reviewed. The femoral head was slightly eccentrically located in the cup and minor osteolysis proximal to the cup was observed. The delay until revision caused implant failure and excessive osteolysis.

Early re-operation, despite no clinical symptoms, with exchange of the liner if the shell is intact, downsizing the femoral head for thicker polyethylene and grafting of the osteolytic lesions are recommended. ACS acetabular construction with thin polyethylene and superior rim bearing should be abandoned, and is withdrawn from the market.

Obesity predispose to hip arthrosis

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Osteoarthritis is a slowly evolving degenerative disease affecting cartilage and bone. The etiology appears to be multifactorial. One factor that has been studied with inconsistent results is overweight (or obesity). Only a few population based studies have shown overweight to be a risk factor. The purpose of this study was to estimate the relationship between obesity and arthrosis of the hips based on a population study.

Material and methods: 4151 persons, median age 63 (21–90) years, living in Østerbro/Copenhagen were selected randomly and accepted to participate in a physical and radiological examination including both hips in the antero-posterior view. The radiographs were classified according to Kellgren's four grades with 0 being no arthrosis and 4 obliterated joint space. We found 3135 without arthrosis and 1006 with arthrosis (721 with grade 1, 225 with grade 2 and 60 with grade 3). Information from 10 patients was missing.

Results: Analysis was made between arthrosis/no arthrosis and Body Mass Index (BMI) > 30 (obesity) as well as the well known risk factors, sex and age.

Variable	Test	Level of significance
Sex	Chi-square	0.01
BMI > 30	Chi-square	0.04
Age	Mann-Whitney	<0.001

A logistic regression analysis with arthrosis as the dependent variable and sex, BMI > 30 and age was performed.

Variable	Odds ratio	95% C.L.
Sex	1.32	1.12–1.55
BMI > 30	1.36	1.09–1.69
Age	1.69	1.54–1.86

Conclusion: We find that a BMI > 30 is a risk factor for developing arthrosis of the hips.

Satisfactory Outcome Score—a new hip arthroplasty score

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As we have found the Harris Hip score severely biased and less fit for evaluation of the results after THR a new and intended unbiased score system is presented.

Material and methods: 1861 consecutive primary hip arthroplasties, performed between 1978 and 1991 were reviewed. 228 hips were excluded due to bilateral operation, 407 "hips" had died and 185 were failures and thus also excluded from the analysis. The remaining 1041 patients were sent a questionnaire. 963 (93%) questionnaires were returned. In 235 questionnaires at least one question was missed. The remaining 728 questionnaires could be used.

Earlier published and new-designed score systems were statistically tested by use of the Rasch model. Items were evaluated for bias of: sex, age, exposure time, hip disease, earlier hip operation, and bleeding perioperatively.

Results: All tested systems using physically established measuring scales (for example walking-distance) were found biased. A score (SAOS) based on the patients own comparison of the function of the operated hip before and after the operation was constructed. The score system is based on four items: relief of pain, use of analgetics, functional ability and general opinion on the result. This score was found biased only by bleeding perioperatively.

Conclusion: The SAOS score seems promising and non-biased by background parameters. The score system is easy to use and questionnaire based. A reproducibility test and comparative studies with radiographic results is to be performed.

Item-bias evaluation of Harris Hip score

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Harris Hips score (HHS) is the most used hip score system. It is based on several different items (pain, walking distance, functional capabilities, etc.).

Material and methods: 1861 consecutive primary hip arthroplasties, performed between 1978 and 1991 were reviewed. 228 hips were excluded due to bilateral operation, 407 "hips" had died and 185 were failures and thus also excluded from the analysis. The remaining 1041 patients were sent a questionnaire including the main items (91 of the original 100 points) of the HHS. 963 (93%) questionnaires were returned. In 235 questionnaires at least one question was missed. The remaining 728 questionnaires could be used.

By use of the Rasch model the different items of the hip score were statistically evaluated for bias of various demographic variables: sex, age, observation-time, etiology of the preoperative hip disease, other operative interventions before the THR and bleeding perioperatively.

Results: All items were biased by age. A young patient with a suboptimal HHS would most probably have pain problems, while the older patient would have a low score due to functional problems. Female patients often had problems with stairs, public transportation and sitting, while men had problems with shoes.

Conclusion: The HHS should not be used for comparative conclusions between groups of patients with even small differences in age, sex and etiology of the hip disease due to non-visible bias from demographic variables.

Ganz periacetabular osteotomy—preliminary results

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Current treatment for acetabular dysplasia has been primarily limited to total hip arthroplasty (THA). However, results after THA in these young and active patients are very poor, with a high revision rate. An alternative to THA is Ganz periacetabular osteotomy which allows for a three-dimensional reconstruction of the acetabulum. Ganz periacetabular osteotomy was introduced in Denmark October 1996 by our institution.

Patients and methods: To date, 12 Ganz osteotomies have been performed in 10 patients. Mean age was 28 (16-41) years. There were 1 male and 9 female patients. Two patients were operated on bilaterally. All operations were done using epidural hypotensive anesthesia. Mean blood loss was 1200 ml and mean operation time was 3 hours. CT-scannings of the hip with 2-D and 3-D reconstructions were performed in order to obtain detailed information on the degree of 3-D correction required for the acetabulum during surgery. Mean observation period was 6 (3-15) months.

Results: Clinical results were evaluated using Harris Hip Score (HHS). Preoperative HHS was 60 and 6 months postoperatively the HHS improved to 93. The mean preoperative Center Edge (CE) angle was 6 (-6 to 15) degrees. Postoperatively the CE angle was corrected to 34 (26 to 46) degrees.

There was no infection, no deep venous thrombosis, no major neurovascular complication, no heterotopic ossification, no hardware removal and one delayed union. Three patients had dysaesthesia of the lateral part of the femur due to stretching of the lateral femoral cutaneous nerve.

Conclusion: Ganz osteotomy is a challenging operation, and early results are encouraging as a significant reduction in pain was demonstrated. The operation allows for a 3-D correction of the acetabulum, which may prevent or at least delay further development of arthrosis in these young patients.

KNEE

The Elmslie-Trillat procedure—a retrospective evaluation

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The gathering of comparative data for the postoperative evaluation of long-term results following corrective operations for patellofemoral instability/malalignment was found to be problematic in relation to both subjective and objective findings. Turba et al. (1979) have created a method which simplifies and standardizes the postoperative evaluation system. Combined with Sjølund's (1988) classification of symptoms and Dandy & Pourier's definition of chondromalacia, we believe this to be a strong tool for postoperative evaluation.

Material and methods: Operations based on the Elmslie-Trillat procedure were carried out on 29 knees, representing 24 patients of which 23 patients were included in a medical report study and 21 patients took part in an outpatient examination. These 21 patients were divided into 3 groups in accordance with Sjølund's model, and both the subjective and objective findings were systemized in accordance with Turba's evaluation method.

Results: Group A: 15 operations with patellofemoral instability without clinical chondromalacia. Group B: 2 operations with patellofemoral instability and clinical chondromalacia. Group C: 9 operations with malalignment and/or patella alta and clin. chondromalacia.

Conclusion: We conclude that the E-T operation can be offered to patients in Group A and Group C unrelated to age or sex. Patients in Group B can be offered the E-T operation, but the operation cannot be expected to result in eradication of knee pains. Postoperative immobilization with a hinged bandage for 6 weeks is recommended as allowing unrestricted movement/strain below the pain limit. All patients should be offered removal of the screw(s) 6-12 months following operation. A lateral prepatellar incision is recommended.

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Total knee arthroplasty with the AGC-knee—a prospective multicenter study¹ of 1,036 knees with 5-years follow-up

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The material represents nearly 60% of the yearly Danish total knee arthroplasties (TKA) and the aim of this study was to evaluate the results after 5 years.

Material and methods: From February 1 1989 to December 31 1990, 936 patients were included at the 14 participating departments. 727 of the TKA's were cemented, 260 uncemented and 49 were hybrids. Clinical and radiographic parameters were obtained pre-, post-operatively and at the 1-, 3- and 5-year follow-up.

Results: At the 5-year follow-up the patients of 184 TKA's were dead and 107 had been excluded leaving 745 prostheses to the study. The mean NYHSS-score had improved from 55 preoperatively to 84 at the 1-year follow-up, was 85 at the 3 and 5-year follow-up. After 5 years 87% of the patients were satisfied or very satisfied with the over-all result. In the first year postoperatively 1.4% of the implants were revised and 1.1% had been subject to deep infection. After 5 years these figures were 5.3% and 1.4% respectively. Failure of the patellar component (almost entirely metal-backed) accounted for 60% of the revisions.

Conclusion: TKA with the AGC-knee provides satisfactory over-all results after 5 years. The patellar component was the major cause of revision.

1) Departments of Orthopedics participating in the multi center study: Aalborg Sygehus, Aarhus Amtssygehus, Bispebjerg Hospital, Erichsens Klinik, Esbjerg Centralsygehus, Frederiksberg Hospital, Haderslev Sygehus, Herlev Sygehus, Hillerød Centralsygehus, Hvidovre Hospital, Nykøbing Falster Sygehus, Slagelse Centralsygehus, Sønderborg Sygehus and Vejle Sygehus.

Treatment of cartilage defects with autologous chondrocyte implantation—preliminary results

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Since the publication of Brittberg's (1994) work on chondrocyte transplantation there has been an increasing interest in the treatment of cartilage defects. A Danish MTE-rapport (Oct. 1997) demonstrated lack of scientific evidence for the effect of many different treatments on cartilage defects. Before going into controlled studies we found it of interest to investigate whether Brittberg's method, with a few alterations, would work in our hands.

Material and methods: 17 patients aged 22–50 entered the study. All patients had a long history of knee dysfunction; pain, swelling, reduced range of motion and intermittent locking of the knee. Diagnosis was obtained after arthroscopy. The patients were then selected for a two stage operation: Harvesting of cartilage from damaged knee and three weeks later a second operation where the defect was covered with a periosteal flap (4 patients) or a biogide membrane (11 patients). Cultured chondrocytes were then injected under the membrane. Only defects on femoral condyles (three lat, 14

med) were treated. The size of the defects being from 2–12 cm². MRI scans were done preop., and 2 and 12 months post op. The patients had control arthroscopy at 3 and 12 months, and a biopsy was taken after 12 months. The cultivation of cells were done on autologous serum by Verigen Transplantation Service (at a cost of DKr 17,500).

Results: Two patients were followed for 12 months and biopsies were taken. Nine patients were followed up after 3 months (february 98). All patients had a good to excellent result, being almost free of symptoms and ready to start on the job market. Biopsy showed articular-like cartilage. There were no infections or other complications.

Conclusion: ACI seems to be a safe procedure. Our results are as promising as those of Brittberg and Petersons and we are very much encouraged to start further studies.

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Osteochondritis dissecans of the knee treated with periosteal transplantation

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The treatment of osteochondritis dissecans (OD) is still controversial. We present long-term results in patients treated with periosteal transplantation.

Material and methods: Between 1986 and 1991, 18 cases of OD of the knee in 18 patients (7 women, 11 men) were treated. Median age 19 (16–45) years. The OD was located to the femoral condyles in 16 patients, and to the patella in 2 patients. The size of the lesions were less than 4 cm² in 12 patients, and more than 4 cm² in 6 patients. The cartilage defect was excavated, and periosteal transplantate from the tibia was fixed in the defect with Tisseel fibrin adhesive. Full weight bearing was allowed after 10 days.

Results: Within 1 year after the operation, 6 patients had performed brisement due to reduced range of motion. 8 patients had undergone 8 arthroscopies and 1 arthrotomy up to 8 years postoperatively, due to reduced range of motion, synovitis, or formation of an exostosis in the transplanted area. 14 of the 18 patients were available for follow-up. 6 patients were satisfied with the result. None had daily knee pain. Only 2 patients were completely pain free. Only 3 patients took part in leisure sports. 6 patients had reduced range of motion, knee instability or quadriceps muscle atrophy.

Standard radiography showed OD lesions in all but one of the patients.

Conclusion: We have not been able to achieve the good results presented in the literature after short time follow-up

studies of OD treated with periosteal transplantation. The number of reoperations and the continuous knee pain in most patients does not justify the extensive procedure of periosteal transplantation, and we do not recommend this method.

Ketoprofene (Oruvail®) in preventing synovitis after ACL reconstruction—a prospective, randomized, double-blinded study

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Postoperative synovitis limits the rehabilitation after knee surgery. Others have shown that NSAID can reduce synovitis after meniscus surgery.

Materials and methods: During the years 1995–1997, 67 patients having ACL-reconstructions (patella BTB) were randomized into two groups: Double blind administration of tabl. Ketoprofen 200 mg or placebo, one tabl. every evening from the preoperative day until 14 days postoperatively. Preoperatively, the day of discharge, 2 and 4 weeks post-operatively we measured on both knees: Skin-temperature, ROM and circumference. VAS-scores and use of analgesics were registered. Six patients were excluded, 5 because of dyspepsia, 1 because of withdrawal. Of the remaining 61 patients 32 were given Ketoprofen (*K-group*) while 29 were given placebo. Preoperatively there were no differences between the two groups regarding sex, age, operative delay, mean VAS-score, ROM, skin-temp. or circumference of the knee. Postoperatively all patients had cryo therapy (Cryo-cuff) on the operated knee for the first 24 hours.

Results: There was no difference in the number of days before discharge from hospital between the *K-group* and the placebo-group.

By the time of discharge the *K-group* had significantly less swelling of the operated knee (circumference) compared with the non-operated knee than the placebo-group (mean 3.0 cm vs. 4.1 cm difference, $p=0.03$). There were no differences in skin-temp., ROM or VAS-score.

Two weeks postoperatively the only significant differences between the *K-group* and placebo-group was a lower markedly consumption of analgesics (mean 2.9 g vs. 8.4 g of paracetamol, $p=0.01$) and a lower difference in skin-temperature (operated minus non-operated knee, 3.4° vs. 4.7° , $p=0.03$) in the *K-group*. No differences were observed regarding circumference of the knees, ROM or VAS-score.

4 weeks postoperatively the *K-group* compared with the placebo-group had significantly less swelling of the operated knee (mean 1.6 cm. vs. 2.0 cm. higher circumference than the non-operated knee, $p=0.05$) and lower VAS-scores (mean 1.6 vs. 2.3, $p=0.01$), while no differences were seen in skin-temperature or ROM

Conclusions: 200 mg Ketoprofen administered once daily for 2 weeks after ACL reconstruction seems to reduce swelling of the knee and pain four weeks postoperatively, but

seems not to influence ROM.

Thanks to Rhône-Poulenc Rorer for their contribution to this investigation.

Quality of drainage blood after total knee arthroplasty

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Reinfusion of postoperative wound drainage blood has become an attractive alternative in primary total knee and hip arthroplasty. Quality of the drainage blood was studied with respect to content of extracellular bioactive substances and coagulation split products.

Methods: Using the Handyvac autotransfusion system (Handyvac,) drainage blood was collected and reinfused within 6 hours postoperatively from 10 patients undergoing primary total knee arthroplasty. Blood samples were collected from the patients before and one hour after opening of the tourniquet, and after reinfusion of drain blood. Samples were also collected from the drain blood immediately before and at the end of reinfusion. The leukocyte- and platelet-derived bioactive substances histamine, eosinophil cationic protein (ECP), myeloperoxidase (MPO), plasminogen activator inhibitor-1 (PAI-1), and activated complement factor C3, and various coagulation factors and split products were analysed in patient and drain blood samples. None of the patients received additional predonated autologous blood or allogeneic blood components during the study period.

Results: Within the 6-hour postoperative range 250–1,000 ml drain blood was collected and reinfused. Histamine, ECP, MPO, PAI-1 and C3a content were significantly increased in drain blood immediately before and at the end of reinfusion. However, reinfusion did not change the concentration of these substances in samples from the patients. Coagulation factors (prothrombin time and INR) and various split products showed, that drain blood was decoagulated. Reinfusion of drain blood did not change the patients' coagulative capacity.

Conclusion: Drainage blood appears to be decoagulated and contains various extracellular leukocyte- and platelet-derived substances. Reinfusion does, however, not change the patient's coagulative capacity.

ANKLE/FOOT

Achilles tendon ruptures—a Danish survey of treatment and rehabilitation

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The treatment and rehabilitation of acute achilles tendon ruptures have been discussed extensively in the literature during the last years: acute versus (vs.) conservative treatment, early aggressive rehabilitation vs. immobilisation, full weightbearing vs partial vs non-weightbearing etc. The attempt of this study was to clarify the treatment and rehabilitation used in Denmark.

Material and methods: During 1997 56 departments of surgery and orthopaedics recieved a questionnaire concerning the usual treatment and rehabilitation of achilles tendon ruptures.

Results: 53 of all departments answered. 50 operated unless the patients were too old or there were contraindications against surgery. All used local analgesia. Only 2 always used conservative treatment.

In the surgical group 34 used low plaster of Paris postop, 6 used ROM-bandage and 10 a combination. All but one put the foot in plantarflexion after surgery without weightbearing. All but one changed the cast after 2–4 weeks and placed the foot in neutral position and allowed weightbearing. In 48 departments the total period of immobilisation was between 6–9 weeks.

Only 16 allowed early (between 1 and 4 weeks) controlled non-weightbearing range of motion. 42 allowed return to light sport (cycling, swimming, jogging) between 1–4 month postop. Heavy sport was allowed after > 5–6 months in 42 of all departments. Only 4 offered physical therapy after cast removal

Conclusion: The treatment of achilles tendon ruptures in Denmark is very uniform. The rehabilitation procedure reflects a great variation. This may be due to lack of valid prospective randomised rehab.-studies in the literature.

High complication rates 7 years after lateral ankle sprains

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Ankle inversion injuries are responsible for frequent contacts in casualty wards. Although considered to be "minor" injuries a considerable percentage of patients still have complaints 1 year follow-up studies. The aim of this investigation was to register the frequency of complaints over a considerably longer period.

Materials and methods: Design: prospective registration with mailed follow-up forms. All patients at the casualty ward with a lateral ankle inversion injury during one year were registered, questioned and examined. Seven years later they received a follow-up form with questions concerning pain, swelling, repeated injuries, and functional loss as the primary outcome measures. Non-responders were contacted by phone.

Results: Included subjects: 709. Seven years later 11 were dead and 50 could not be found or would not participate. Thus 648 answered the follow-up form, 42 after a reminder.

Mean age 27 (18–67) years. 42% women. Severity of primary lesion considered clinically: Grade I: 39%; Grade II: 46%; Grade III: 15%.

Frequency of complaints: 212 subjects (33%) complained of sequelae after the registered sprain or subsequent sprains of the same ankle. 107 subjects avoided certain activities due to ankle complications (17% of the whole group; 50% of those with complaints). *In the subgroup with complaints:* Pain: During activity: 75%. At rest: 14%. Swelling: Chronic: 38%; Intermittent: 48%. Repeated inversion injuries (more than 4 a year): 25% (8% of the whole material).

Conclusion: Seven years after a casualty ward registered lateral ankle inversion injury, 33% of the subjects had complaints of pain, swelling, and/or repeated inversion injuries. 17% felt that the problems reduced the level of their activities.

Intraarticular glucocorticoid, morphine and bupivacaine reduce pain and convalescence after arthroscopic treatment of impingement of the ankle joint

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Convalescence after treatment of impingement of the ankle joint by arthroscopic removal of bony spurs and synovitis is affected by pain and the inflammatory response. The aim of the study was to investigate the effect of intraarticular bupivacaine + morphine + methylprednisolone versus saline on postarthroscopic pain, mobilisation and convalescence.

Material and methods: In a double-blind randomised study 36 patients undergoing arthroscopic treatment of impingement of the ankle joint were allocated to intraarticular saline or bupivacaine 15 mg + morphine 5 mg + intraarticular methylprednisolone 40 mg. Pain during walking, use of crutches and duration of sick leave were assessed.

Results: Combined methylprednisolone, bupivacaine and morphine reduced pain, time of immobilisation and duration of convalescence after arthroscopic removal of bony spurs and synovitis of the ankle joint.

Conclusion: A multimodal analgesic and antiinflammatory treatment may have a beneficial effect on postarthroscopic convalescence, which depends on the trauma induced inflammatory response and pain.

Diabetic plantar abscess—a prospective study of microbiology and results

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Deep infection of the foot in patients with diabetes mellitus is common, with longlasting morbidity, increased mortality, and a 50% risk of amputation proximally to the ankle joint. Often several microbiologic agents are found: Staph. aureus, anaerobic bacteria, Gram-negative rods and fungi.

The purpose of the present investigation is to assess the microbiology of a well defined group of patients with diabetic plantar abscess, together with the outcome and diabetic status.

Material and methods: 12 patients (8 males) aged 54 (39–74) years were admitted with a deep plantar abscess (Wagner's grade 3 and 4). 5 patients had IDDM, and duration of DM was 15 (0–35) years. 9 patients had a previous foot infection.

At operation 3 biopsies from most infected areas (bone, peritendinum or fascia plantaris) were obtained, together with a common swab. The specimens were handled like Kamme biopsies, and cultured for both aerobic and anaerobic bacteria.

Results: At primary operation a wedge-resection (1 or 2 rays) was performed in 2 cases, and a toe-amputation in 1 case. Secondary a lower leg amputation was done in 2 cases, and a femoral amputation in 1 case. 9 patients healed in 11 (3–24) months.

3 patients were infected with one organism (two with Staph. aureus and one with Proteus mirabilis). Staph. aureus was found in 8 cases; Streptococci in 3 cases; Gram neg. rods in 5 cases; and anaerobic bacteria in 6 cases.

Sensory neuropathy was detected in 9 cases.

Conclusion: Diabetic plantar abscesses are often polymicrobial, and in order to obtain a relevant diagnosis, biopsy specimens are recommended. Primary antibiotic treatment directed against Staph. aureus and anaerobic bacteria is justified, due to the high number of these species in the present study.

TUMOR

Bone reconstruction after pelvic resection

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Many malignant pelvic tumors can be resected without amputation of the lower extremity, allowing the same margin

that would be obtained with a hindquarter amputation. The aim of the study was to discuss the most important principles of treatment with examples from our clinic.

Material: Pelvic resection types are described as type I (iliac), type II (periacetabular) and type III (obturator). Resections involving the sacrum are referred to as type IV. In most cases reconstruction is not mandatory. However, the functional results are better after type I and II resections if the pelvic ring can be preserved or reconstructed. In type II resections an arthrodesis or a mega prosthesis is preferred. If the first sacral segment also has to be resected (total type IV) the ilium must be fused to the spine.

Methods: Bone grafts: Massive allograft or re-use of the removed bone after heating is a possibility after type I–III resections. These methods have a high failure rate due to infection and bone resorption. A more promising method is using the patients own fibula with or without blood supply.

Arthrodesis: After type II resections and combined I+II arthrodesis gives a good stability and is preferred in growing children. Postoperatively the patient needs a special external brace until healing. Arthrodesis is the method of choice after sacrum resections (type IV).

Mega prosthesis (with or without a pelvic prosthesis): May be used after type II and combined I+II resections. Often an external brace has to be used for some months to avoid luxation.

Discussion: The limb saving procedure to be used after a specific bone resection depends on several factors including the possibility of getting allograft bone. Soft tissue cover is mandatory. For bone grafting we prefer the fibula graft. In growing children we prefer arthrodesis and in adults a mega-prosthesis with or without a pelvic prosthesis.

EXPERIMENTAL ORTHOPEDICS

Osteogenic Protein-1 Device® in combination with bone allograft and Pro-Osteon 200® around non-cemented implants

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Early incorporation of bank bone allograft is mandatory in the revision of arthroplasties.

We investigated whether the OP-1 (BMP-7) device (Stryker Biotech) further whether enhanced bone incorporation around implants and Pro-Osteon 200 might be an alternative to bone allograft.

OP-1 is a growth factor which stimulates bone formation.

Pro-Osteon 200 (Interpore) is a coralline hydroxyapatite bone substitute.

Material and methods: 6 labrador dogs each had 4 unloaded cylindrical hydroxyapatite coated implants inserted in the distal femur for 3 weeks. A 3 mm gap was left around each implant, which was filled according to the following groups: 1) allograft, 2) Pro-Osteon, 3) allograft + OP-1, and 4) Pro-Osteon + OP-1. The amount of Pro-Osteon, OP-1 and allograft was standardized by weight.

Results: Push-out testing showed, that OP-1 device enhanced fixation of Pro-Osteon by 900%. No significant differences were found between Pro-Osteon + OP-1 and allograft with or without OP-1. No difference between allograft with or without OP-1 was found.

Histomorphometry confirmed an increased new bone formation and an accelerated resorption of allograft and Pro-Osteon when OP-1 device was added.

Conclusion: OP-1 device improved gap healing and accelerated resorption of bone allograft and Pro-Osteon. Furthermore, implants treated with bone allograft were much more severely fixated than implants with Pro-Osteon alone. However, implants with Pro-Osteon combined with OP-1 were equally well fixated compared to the allograft group.

Effects of experimental perfusion before replantation

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The purpose of this experimental study was to compare the effect of perfusion by the University of Wisconsin solution (Viaspan®) to that of the Perfadex® solution on the reduction of the irreversible muscle necrosis exposed to total ischemia and reperfusion in the hindleg of rats. Both solutions are made for preservation of ischemic tissue and for diminishing reperfusion damages. UW is an "intra-cellular type" based on a high potassium level and added raffinose and scavengers. Perfadex is an "extra-cellular type", a low-potassium-dextran 40 added scavengers, insulin, and nitroglycerin.

Materials and methods: The study population of 66 rats was subdivided into 3 groups according to the 2 perfusion solutions and a control group. At operation all animals were placed on a 38°C surface, exposed to 3 hours of total ischemia in one leg followed by 24 hours of reperfusion. Bloodgas, blood potassium level, and periferal blood flow were measured. The 10 °C solutions were perfused during 20 minutes (1 ml/min) before revascularization. Muscle survival was estimated in m.soleus by Nitro Blue Tetrazolium and quantitative planimetry.

Results: Muscle survival in the control group (n=22) was 49%±16, the group perfused with UW-solution (n=20) 84%±15, and in the group perfused with Perfadex (n=24) 85%±5. After 24 hours the potassium level was significantly increased in the control group and the UW group. The primary post-ischemic blood flow was significantly higher in

the Perfadex group. In all groups pH was kept within normal values during ischemia and reperfusion.

Conclusion: Perfusion before revascularization showed highly significant reduction in muscle necrosis with both types of preservation solution. The future experiments with larger animals like pigs will show whether we should consider an intra- or extracellular type of solution in human replantation.

EPIDEMIOLOGY

Treatment of tibia-shaft fractures in Denmark—results of a questionnaire

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Several aspects concerning the treatment of tibia-shaft fractures (TF) remain controversial. We present the results of a nationwide questionnaire study.

Material and methods: In october 1997 a questionnaire was mailed to all orthopaedic departments and departments of surgery including orthopaedic surgery. 100% of the orthopaedic departments in university hospitals (OUD), 88% of the remaining orthopaedic departments (OD) respectively 100% of the combined general and orthopaedic surgery departments (CGO) answered the questionnaire.

The questionnaire included 4 sections i.e. a general section concerning antithrombotic and antibiotic regimes and use of invasive intracompartmental pressure measurements; treatment of TF classified according to their stability, Gustilo-Anderson grade and amount of energy involved; TF in children; and treatment of infected tibial pseudoarthroses.

Results: 70% of the OUD, 61% of the OD and 55% of the CGO used antithrombotic regimes. All departments used antibiotics in cases of open fractures. 78% of OUD, 65% of OD and 50% of the CGO used antibiotics when closed fractures were operated. 30% of all departments used invasive pressure measurements. In cases of closed TF with instability 60% of the departments used external fixation (EF) and 62% used intramedullary nailing (IMN). In grade I and II open fractures 40% use IMN. In high energy grade III open TF 18% used IMN as compared to EF which is used by 93% of the departments.

Conclusion: IMN and EF dominates the treatment. No consensus seems to exist.

Multidisciplinary in-depth analyses of 17 head-on collisions

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In 1996 The Danish Ministry of Transport established the Road Accident Analysis Group (AVU) in 1996. The group consists of psychologists, road- and vehicle engineers, a police superintendent and a medical doctor. The group's objective is to improve road safety through implementing results from multidisciplinary in-depth investigation and analysis of specific types of accidents.

Material and methods: 17 serious (dead or serious injury) head-on collisions between motor-driven vehicles. The analyses were based on police reports, blood tests, investigations of accident sites and vehicles, interviews with drivers, passengers and witnesses, and AIS/ISS coding. All interviewees were guaranteed anonymity.

Results: Eight of the 17 accidents were fatal. All 17 "active" drivers were male.

Accident factors: High speed (8 accidents), mental state (7-9), alcohol, narcotics and medicine (7), driving technique (6-7) and inexperience (4).

Injury factors: Did not use safety belt (9 accidents), drove in older and smaller vehicles (13), road/environmental conditions (1).

Conclusion: Young men driving at high speed and under the influence of alcohol/narcotics present a serious hazard in the traffic. Motorists in older and smaller vehicles, and who do not wear seat belts have a high risk of becoming seriously injured in head-on collisions. Accident prevention: Forced speed reduction (intelligent speed regulators, humps, narrowing of road in sharp curves), limiting alcohol and narcotics in traffic (alco-locks, vehicle impounding, license suspension), driving technique (improved education).

Injury prevention: Safety equipment (encourage seat belt use, airbags) and mandatory inspection of older vehicles.

The epidemiology of Achilles tendon rupture in a Danish county

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The purpose of this study was to determine the epidemiology of Achilles tendon ruptures (ATR) with particular emphasis on describing age and sex distributions and its relation to sports activities in a Danish County.

Patients and methods: During the years 1984-1996, 718 patients with an acute ATR were registered in one of the Orthopedic Departments in Ribe County in Denmark for primary treatment. The data collection was made in a retrospective fashion at five hospitals, serving a population of 220,000

co-operated. The Hospital Discharge Registers and EHLASS were used to find all ATR. Student's t-test was used to test whether this correlation coefficient was significantly different from zero.

Results: There were 544 men (75.8 %) and 174 women (24.2 %). The average age was 42.1 (3-82) years. 643 ruptures (89.6%) were treated surgically, and 75 ruptures (10.4%) treated conservatively. 73% of the ruptures were related to sports, mostly badminton. The annual incidence of ATR increased from 18,2/105 inhabitants in 1984 to 37,3/105 in 1996, and this rise was related to sport. The peak incidence in the sport-related cases occurred primarily in the age group 30-49 years and in nonsport-related occurred in the age group 50-59 years.

Discussion: The incidence of ATR is increasing, probably on account of increased interest in recreational sports. The sex ratio in our study disclosed a higher proportion of females than reported in previous investigations. This phenomenon could be explained by increased activity among females.

Data registration in an accident and emergency department using a special designed registration form

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In an earlier investigation the data collected concerning trauma treatments at our hospitals A&E department were validated, and serious amounts of data were missing or were biased by possible misclassification. Considering the use of data for epidemiological purposes, we wanted to evaluate the validity of data after changing the procedures for data collection and design of a new registration form for data collection.

Material and methods: In phase one the study was based on a sample of 255 randomly taken case records over a period of 9 months, and data from the county's central data base concerning all outpatients in the A&E department (2638) in the same period were extracted for comparison. All case records were examined to conclude, whether data were based on facts or on interpretation.

In phase two a new special registration form was tested in 382 patients.

Results: The new registration form improved the registration, but a considerable amount of data were still missing. Of the 382 forms we found missing data in 163 (43%). Most of the registration forms only missed one category of data, and there was improved registration in all categories but one with missing data in 3-16% of the forms.

Conclusion: Special registration forms improve data collection at A&E departments, but there is still a serious risk of bias due to missing data. We recommend other Hospitals to validate their local data and collection procedures.

Introduction of electronic patient journal in an orthopedic department

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Based on results from a pilot project carried out in the autumn 1996, the orthopedic department at Vejle Hospital decided, in cooperation with the management of the hospital and the county, to implement an electronic patient journal (EPJ) as an operational project.

EPJ was adapted to the demands of the department in close cooperation between a project manager, a group consisting of a doctor, a secretary, and a nurse together with the supplier. Besides the group, six experts were trained and afterwards these persons trained another 250 employees during a two days course concerning elementary use of EPJ.

The change from a traditional paper journal to EPJ is a very great change both mentally and practically. The journal creates new possibilities for structuring and survey. The medical group gets advantages, as the data of the patients are easy to find and always present, increased security, immediate connection to other medical references (e.g. the medical catalogue) and quality control of the medical work.

The journal, which is accessible to doctors and nurses, started to operate on the 01.09.1997. Today is given a presentation of the actual version of the journal, with special focus on structure and general view.

How adequate do the data files in the casualty department describe the occurrence of occupational hand injuries?

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The purpose of the study was to describe the proportion of persons with self-reported hand injuries in a danish population who attended the casualty department for treatment, and to investigate if any specific age, gender and occupational selection exist for hand injured persons attending the casualty department.

Material and methods: 119 persons with occupational hand injuries were identified in a random sample of 3,905 persons in the catchment area of Odense University Hospital. The proportion who had attended the hospital for treatment was registered. Age, gender and occupation were tested together with the severity of the hand injuries in a logistic regression model to identify independent indicators for attending the hospital for treatment.

Results: The proportion of persons with self-reported occupational hand injuries who attended the casualty department for treatment was 0.28, for injuries with disability and time off work the proportion was respectively 0.46 and 0.69.

No age, gender or occupation specific selection for attending the hospital was found.

Conclusion: Based on the results from this investigation, where between one half and two thirds of the more serious hand injuries attend the hospital, it is recommended that the data files in the hospital are used increasingly in future prevention programs.

Roller skating injuries indoor versus outdoor

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By opening a new sports centre provided for indoor roller skating, a sudden increase of injuries from this location was registered at the casualty department. This fact brought us to evaluate and compare the injuries to those affecting outdoor roller skaters. The aim was to determine whether there was any difference in the type of injuries between indoor and outdoor roller skating. Parametres such as level of experience, use of protection equipment and possible alcohol intoxication was taken into account.

Material and methods: A number of registred injuries occurring at the roller skating centre at Vejle over a three-month period. Besides a number of injuries caused by outdoor roller skating over an equal period of time. A total of 39 plus 85 cases included in the study.

The patients were secondly asked about skating experience, use of protection equipment and possible alcohol intoxication at the time of injury.

Results: On comparing injuries from indoor roller skating to those of outdoor roller skating no significant difference between the two groups was found. The most common injuries are those to the upper extremities, especially the wrist. Fracture is the most frequent injury with a fracture incidence of radius/ulna of 64.7 %.

No serious injuries to the head were observed. Apparently the type and seriousness of the injuries cannot be related to the experience of the skaters. Only a limited number of patients wore protection equipment. Only a minority had consumed alcohol implying that none have had more than two units.

Conclusion: No difference in the pattern of injuries can be proved when outdoor skating is compared to indoor skating.

Likewise no significant differences in the pattern of injuries are found between experienced and inexperienced roller skaters.

From our point of view this indicates that there would not be any prophylactic advantage in establishing special centres or areas for roller skating instead of public roads. All the same you might reduce the number of serious lesions to the head which have already been observed around the world.

As a consequence of this study and other studies it must be strongly recommended to use protection equipment – especially wrist pads.

Rollerskate-accidents in Viborg—a retrospective study of the years 1995–1997

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Rollerskating is an increasingly popular recreational sport. In the years from 1995–1997 there has been a marked increase of rollerskate-accidents reported in the Accident and Emergency Department (A+E dpt.) of Viborg Hospital. The aim of the study was to analyze injury pattern and the use of protective gear among patients treated at the A+E dpt. after roller-skate accidents.

Material and methods: We performed a questionnaire including 276 patients during the period 1995–1997. The questionnaire was asking about rollerskating habits, injury circumstances and the use of protective gear.

Results: 82.9% (229) answered the questionnaire. Median age of 13 (3–68) years. Submitted in 1995 – 0, 1996 – 4, 1997 – 14.

Overall 68.7% (189) injuries involved the upper extremity (U.E), fractures in 49.7% (94) of which wrist fractures alone account for 81.9% (77). Lower extremity 21.5% (59), fractures in 27.1% (16). Head and neck 7.3% (20) no fractures. Others 2.2% (6) including one death and one paresis of n. peroneus.

Accidents locations, public road 45%, pedestrian area 29.2%, rollerskating tracks/homes 25.8%. Single-accidents account for 84.3% with 45.0% claiming hindrances present (gravel, stones, holes etc.) causing the solo-accident. In counterpart-accidents, most often another rollerskaters 25.0%, bicycles/mopeds 22.2% or cars 16.7% were involved.

Most often rollerskates were used for playing 61.0%, exercise 24.1% and as transportation 11.4%. Only one patient was under the influence of alcohol. **Experience** at accident time was < 3 month (43.2%) or >12 month (37.4%). 71.4% used In-liners, side by side 24.2% and rollerballs 4.4%. **Protective gear** was bought by 60.3% (138) but only used by 51.4% (71).

Conclusion: Upper extremity lesions and wrist fractures are common in patients treated at A+E dpt's after rollerskate accidents. Protective gear was used by few of the treated patients and future studies have to focus on behaviour, prevention and risk analysis among rollerskaters.

Comparison of in-line skating injury with rollerskating—a prospective study

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Rollerskating is an increasing recreational activity that carries with it the potential for injury. The aim of this study was to determine the types of injury sustained during the use of in-line skates (IS) and to compare them to roller skates (RS).

Material and method: During a 7 month period in 1997, 407 patients with injuries resulting from IS & RS were treated in the ED, Esbjerg County Hospital. All cases reported in the above mentioned period were reviewed.

Results: Of the 407 patients, 300 (74%) were IS, and 107 (26%) were RS. Minor injuries were more common than fractures, and there was no significant difference in the types of injury between skater groups. The most common serious injury was fracture of the forearm, which occurred in both skater groups. More fractures of the distal forearm or elbow occurred among skaters who had not been wearing wrist or elbow guards. Only 20% of skaters used any protective equipment. 20% of all fractures and 22% of all wrist fractures occurred in persons without experience on the first day. 69% of all accidents occurred on a public road.

Conclusion: Injuries sustained by IS were similar to those sustained by RS. Because wrist fractures were the most common type of injury in both, wrist protection was needed and head protection by helmet was recommended.