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Conservative treatment of degenerative diseases of the cervical spine

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Eighty patients with radiologically verified cervical discopathy or spondylosis, ranging in age from 45 to 81 years, were interviewed about their complaints, the result of conservative treatment, if given, and the course of complaints if left untreated.

Twenty-four (30 per cent) of these patients had no complaints. Forty-one (51 per cent) had periodical complaints but these were bearable and there was no reason to consult a specialist. The remaining 15 patients had fairly permanent complaints, but varying from day to day. None had undergone or wished to undergo surgery.

Ten of the last-mentioned 15 patients responded well to conservative treatment. The following sequence was chosen:

1. Explication of the complaints and explanation of the natural history of the condition, which is in fact a normal process of senescence.
2. Medication.
3. Local heat application.
4. Massage of the hypertonic muscle groups in the neck and humeroscapular zone, supplemented by posture-correcting exercises if necessary. The latter, however, are often precluded because structural intervertebral changes have already developed.
5. Given strictly localized pain-points, infiltration of the trigger-points with a "caine" derivative can be effective.

Manipulation of the cervical spine is superfluous and not without risk.

Cervical spondylodesis in the treatment of myelopathies in rheumatoid arthritis

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Between 1961 and 1982, cervical myelopathies were diagnosed in 43 patients with destructive rheumatoid arthritis. Thirty patients were treated by operation.

Indication: severe nuchal pain and radiologically demonstrable changes at one or several levels, responsible for neurological signs and symptoms. Treatment consisted of spondylodesis, if necessary combined with enlargement of the foramen magnum, removal of the posterior arch of C1 or laminectomy at a lower level. The operation was performed jointly by a neurosurgeon and an orthopaedic surgeon. Halo traction, preferably on a circular bed, was prescribed before and after the operation. This traction was replaced by a soft neck collar 2.5–3 months after the operation.

Changes were located at C1–C2 in 20 patients, at some level caudal to C2 in five, and both at C1–C2 and lower in the cervical spine in nine patients.

In all cases the neurological signs and symptoms largely disappeared after the operation, but dislocation with symptoms subsequently developed at another level in four.

At a recent follow-up, ten patients were still alive. Seventeen of the 24 deceased patients had died from causes not related to the cervical problems. Eight of the survivors were satisfied with the result of the operation, but still severely incapacitated by the rheumatoid arthritis. Two patients subsequently developed fresh neurological signs and symptoms. In one, these were due to changes at a lower level, 12

years after the operation. In the other patient the cause remained obscure. Extension of the spondylodesis gave a reasonable result in the first case.

Treatment of changes in the cervical spine

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Degenerative changes within the cervical motor unit segments may result in constriction of the spinal canal and the intervertebral foramina as a result of osteophyte formation. Osseous ankylosis between two adjacent vertebrae is nearly always followed by resorption of these osteophytes. The same can be achieved by anterior intercorporal spondylodesis. Between 1977 and 1983, 96 patients were treated by anterior excision of disc remnants, peroperative removal of posterior osteophytes and intercorporal spondylodesis. A separate autograft was used for each level. Immediately after the operation the patient was allowed up in a baycast Minerva plaster, to be discharged on the seventh postoperative day. No peroperative or postoperative complications occurred.

A follow-up was performed on 72 patients after an average of 31 months (range: 6 months to 6 years). In these patients, 46 males and 26 females, 126 levels had been treated, of which 50 per cent were C5–C6 and 34 per cent C6–C7. The patients were between 20 and 70 years old (average age: 47 years). A post-traumatic problem was involved in 36 cases.

Results: 56 patients were entirely satisfied, nine were partly satisfied (including four with spondylodeses at two levels) and seven patients were not satisfied. In ten cases persistent or recurrent complaints prompted another cervical myelography. Aggravation of existing pyramidal tract symptoms was observed in one patient.

Anterior cervical spine fusion in treatment of cervicobrachialgia

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Traumatic and degenerative changes in the spinal column at the level of the neck are a frequently occurring source of pain in the neck, often associated with radiculopathy and sometimes even myelopathic symptoms.

The signs and symptoms can generally be attributed to an instability problem, for which unfortunately, there are no specific criteria. If conservative treatment does not help, then a good result can be achieved by an intrinsically stable intercorporeal fusion according to our modified Robinson technique. An EMG and cervical myelogram must be carried out before surgical stabilisation takes place.

In the period between 1967 and 1983, 213 patients underwent an anterior cervical spondylodesis. In 154 patients with an average follow-up period of 9 years, there were 96 cases with a good result, 26 with a satisfactory result and 32 with a poor result.

Pain and paraesthesiae disappeared most frequently after surgical stabilisation.

The results can be considered good and correspond with those described in the literature.

Indication for anterior cervical spondylodesis in 96 patients with discopathy and neurological symptoms

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In the course of 6.5 years we operated on 104 patients at 205 levels. Ninety-six of these patients were examined after an average follow-up period of 3 years and 8 months.

Indication: progressive neurological symptoms with demonstrable radiological changes. To determine the level of operation, discography was performed during the operation. This revealed a discopathy at 79 levels, which was treated by spondylodesis. Per level, a separate bone chip was inserted.

Complications: psychotic symptoms developed in nine patients, most of whom had been treated at multiple levels. Three patients developed a pseudarthrosis at C5–C6, and six at C6–C7. The risk of pseudarthrosis increased with an increasing number of levels per patient. A discopathy at an adjacent level subsequently developed in eight cases, in seven of which no discography had been performed at this level.

Results: pain, paraesthesias, headache and dizziness diminished appreciably; no functional improvement was seen. Twenty-five per cent of the patients had complained of stiffness. Neurological improvement was slow. Radiological examination revealed dorsal osteophytes in 84 patients before operation, and in 43 at follow-up. A constricted foramen was observed in 67 patients before operation, and in 23 at follow-up. Two patients were subjectively worse after than before the operation; one was objectively worse. Eighty-one per cent of the patients expressed great

satisfaction; 93 per cent showed marked improvement.

Operative strategy in degenerative diseases of the cervical spine

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Despite increasing pain and dysfunction, complaints due to degenerative changes of the cervical spine are rarely objectifiable, and psychological causes cannot be excluded. An imperative indication for operative therapy is therefore rarely determinable.

Operative therapy can be considered when the symptoms have persisted for years, all conservative measures have failed, and provided no more than two segments are involved.

Operative intervention should be without risk and without undue stress for the patient. The Robinson and Magerle procedure as modified by us meets these requirements. By dilating the intervertebral space and releasing the uncinate process, two pelvic chips can be solidly wedged in. The hospital period is limited to 1 week and functional postoperative therapy follows.

Between 1974 and 1979, we fused 29 levels in 20 patients: C5–C6 or C6–C7 was the level involved in 25 cases. All patients wer checked regularly, and all were traced for a follow-up. No serious complications developed; pseudarthroses were not observed.

Assessment was based mainly on subjective findings. Within the first year 14 of the 20 patients described the result as good, four reported an unmistakable improvement, and two reported a poor result. At the late follow-up, 13 patients described the result as good, one as moderate and six as poor. Nevertheless, 18 of the 20 patients would again submit to an operation. Marked improvement was experienced by 60–70 per cent of the patients.

Surgery for cervical spine metastases

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Metastases or minor pathological fractures in the cervical spine can usually be treated conservatively. Surgical treatment is indicated for:

1. Unstable pathological fracture.
2. Gross destruction of vertebral bodies with severe kyphosis.
3. Cord compression, severe pain or the threat of an unstable pathological fracture, where further radiotherapy or chemotherapy is contrandicated.

Preliminary Halo traction is used to safeguard an unstable cervical spine and reduce pain. At operation, any involved nerve root is decompressed.

Stabilization has evolved to the use of posterior struts held in place by laminar wires. Fixation includes two vertebrae above and two below the diseased level. Involvement of the atlas or axis necessitates inclusion of the occiput by means of a contoured plate and screws. With a life expectancy of more than 6 months, the fixation is enhanced by embedding the metal in bone cement on one side and adding cancellous tumour-free autograft on the other; otherwise, bone cement is added on both sides. Any persistent anterior cord compression is relieved by anterior decompression. Patients are mobilised when comfortable, usually within a few days of operation. Postoperative radiotherapy/chemotherapy is given when possible.

Ten patients have been treated surgically. Stable fixation was obtained and symptoms relieved. Postoperative survivals have ranged from 1 month to 2½ years. No deaths have been related to the cervical spine.

Arthroscopy of the shoulder

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The traditional diagnostic methods for evaluating shoulder pathology do not always provide exact information enabling adequate treatment. After anatomical and arthroscopic studies in cadavers, arthroscopy of the shoulder was introduced in our hospital. A 5 mm 30 degree knee arthroscope was used. The procedure was performed with the patient in a supine position and the shoulder fully mobile.

The gleno-humeral joint was approached between the coracoid process and the humeral head. The subacromial bursa was inspected after inserting the arthroscope 1 cm below the lateral edge of the acromion. In this way arthroscopy was performed in 24 patients with negative findings on plain X-ray, arthrography and E.M.G. (15 male and nine female, average age 44 (range 18–71) years). Three patients had the sensation of a subluxating shoulder; 21 patients had a painful arc.

In the group of patients with a painful arc, in six cases no abnormality was detected; in two cases a chondropathy grade 2 of the humeral head and glenoid cavity was found; in 13 cases sub-acromial

bursitis and inflammatory changes of the rotator cuff were seen.

Two of the three patients with the feeling of a subluxating shoulder had a lesion of the anterior capsule; in the other patient no lesion was seen.

The present study shows that arthroscopy of the shoulder is valuable in those cases where the usual diagnostic methods do not procure satisfactory information.

Conservative treatment of tendinitis in the shoulder

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Between 1978 and 1982, 206 persons (55 per cent of the total number of shoulder problems) were treated for tendinitis in the shoulder. The mean age was 50 (28–76) years. The lesions were distributed over the following tendons: supraspinous in 106 cases, biceps in 14, subscapular in 30, infraspinous in 30 and combined in 26.

The diagnosis was based on clinical findings (motion tests, resistance tests and accurate registration of a painful arc, if any). Radiological examinations were performed in all cases, and in some 50 per cent revealed indirect evidence of a lesion of the rotator cuff, such as a calcium deposit, constriction of the subacromial space with craniad displacement of the humeral head and degenerative changes of the greater or lesser humeral tuberosity.

Although non-invasive treatment was primarily preferred, nearly all patients had already received physiotherapy before referral to the out-patient clinic.

Treatment consisted of a subacromial injection of 1 ml triamcinolone hexacetonide, supplemented with 4 ml mepivacaine 1 per cent, followed by two more concentrated injections at the anatomical site of the lesion. The injection interval was 2 weeks.

With this therapy a cure was achieved in 88 per cent of the cases. Recurrences mainly concerned the supraspinous tendon group. No infections or tendon ruptures were observed after this injection therapy. The therapeutic results are better than those obtained by physiotherapy alone.

Results of Neer's acromioplasty in the treatment of painful arc syndrome of the shoulder

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Between 1979 and 1981, Neer's acromioplasty was used in the treatment of 65 patients (68 shoulders) with a painful arc syndrome. The duration of symptoms exceeded 1 year in two-thirds of these cases. The average age at operation was 48 years. After an average follow-up period of 18 months, objective results were assessed by physical examination, and subjective data were obtained from questionnaires returned by the patients.

Complications were subcutaneous wound infection in one case and myositis ossificans in one case. Overall subjective assessment by the patients described 80 per cent of the shoulders as good-to-excellent. Objective results were good-to-excellent in at least 80 per cent of the shoulders. In six of the 68 shoulders, the patient experienced no alleviation of pain. One shoulder had become worse (myositis ossificans).

Some 50 per cent of the shoulders scored very well both objectively and subjectively (no pain, no functional limitation).

Conclusion: Neer's acromioplasty is a simple operative procedure in the treatment of a long-standing painful arc syndrome which shows no adequate response to conservative measures. A good-to-excellent result can be expected some 10 weeks after the operation in 80 per cent of the patients.

Treatment of lesions of the rotator cuff

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The phylogenetic development of the humeroscapular zone in primates involves an increasing influence of the infraspinous muscle as depressor of the head of the humerus, and a diminishing influence of the supraspinous muscle. The broad aponeurosis of the supraspinous muscle predisposes to friction beneath the coraco-acromial roof.

Transitions between rotator cuff impingement, cuff degeneration and cuff rupture are ill-defined, and aetiologically these conditions may therefore be regarded as a single clinical entity. The Neer pro-

cedure is to be preferred for cuff decompression. In more extensive cuff defects, reconstruction is often possible by advancement of the supraspinous muscle with reinsertion of the cuff.

Of 48 patients with rotator cuff pathology, 37 showed chronic impingement, sometimes with unmistakable degenerative changes of the cuff. A manifest rupture was found in 11 patients. Eight patients with a cuff rupture were satisfied after operative treatment; a good functional result was observed in seven. Treatment was confined to cuff decompression in 37 cases; this was followed by complete disappearance of painful arc symptoms in 23. Fourteen patients with residual symptoms included four with associated lesions of the brachial plexus.

In cases combining rotator cuff pathology with brachial plexus symptoms, a reserved attitude to operative intervention is advisable.

Conservative treatment of acromio-clavicular dislocation: Jones strap versus mitella

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In a prospective study of 19 patients with fresh, total acromio-clavicular dislocation, two methods of conservative treatment were compared. At random, ten patients were given a Jones strap while nine received a mitella. The Jones strap was worn for 6 weeks and frequently checked and trimmed during this period. The mitella was worn for 1 week.

After 1 year, both methods proved to have given equally good results: no pain, no limitation of movement, no loss of strength, but some deformity. Radiologically the dislocation was reduced by 30 per cent in both groups. Degenerative changes of the acromio-clavicular joint were not observed.

Conclusion: both methods of conservative treatment give good results. The Jones strap is more complex and is worn for longer, and consequently merits no preference.

Operative treatment of acromio-clavicular dislocation

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Conservative and operative treatment of acromio-clavicular dislocation both have their advantages and disadvantages. This report describes "conservative operative treatment": after reduction of the dislocation under the image amplifier, the reduced position is retained with the aid of two percutaneous transacromial Kirschner wires. The operation is performed under general anaesthesia while the patient is under daytime care. There is immediate mobilization without weight-bearing, and removal of the Kirschner wires after 6–8 weeks.

Advantages: exact reduction and retention although the intervention is minimal; no need for postoperative immobilization; minimal scar.

Disadvantage: incidental breaking of the Kirschner wires if exposed to loads.

Functional and cosmetic results in a small series of 15 patients were encouraging. Recurrence was observed in only one case. In chronic cases the coraco-acromial ligament is replaced by a graft; this, too, has produced encouraging results.

Operative treatment of acromio-clavicular dislocation

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In the case of total acromio-clavicular dislocation, the acromio-clavicular capsule and the coracoclavicular ligaments are torn: the clavicle is elevated, without contact with the acromion.

Up to 1973, we treated these injuries conservatively by Watson-Jones strapping. Not infrequently, however, patients doing heavy manual work and athletes continued to complain of loss of muscular strength, with additional complaints of pain in the case of subluxation. In some cases the cosmetic result was not acceptable.

Between 1973 and 1982, 45 patients with this dislocation were treated operatively. The coracoclavicular ligaments were exposed; ligaments were sutured and an 8-shaped cerclage of clavicle and coracoid was performed. Next came open reduction and transfixation of the acromio-clavicular joint using Kirschner wire. Finally, the ligament sutures were knotted and the cerclage was fastened firmly with double thread. Functional postoperative treatment was possible. The Kirschner wire was removed after 6 weeks, at the out-patient clinic.

A follow-up study over an average of 5 years has shown that the results justify operative treatment: there are hardly any complaints about loss of strength or pain. The scar is cosmetically acceptable. Functional recovery is complete in nearly all cases,

and work and athletic activities have been resumed without difficulties.

Dacron as ligament graft in the treatment of acromio-clavicular dislocation

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The wide diversity of techniques for operative correction of total traumatic dislocation of the acromio-clavicular joint is matched by the range of problems posed; consequently, the results are not always completely satisfactory.

Operative treatment should aim at immediate, reliable restoration or replacement of the coraco-acromial ligament, permitting early mobilization of the joint. This can be achieved by using Dacron as a ligament graft. This material is strong, bio-inert and readily integrated with host tissues. Used as a graft, it is guided beneath the coracoid and over or through the clavicle, and so knotted as to ensure an anatomical position of the acromio-clavicular joint.

Between 1978 and 1982, 18 patients were thus treated (including a few with a secondary graft). All showed complete restoration of shoulder function. All resumed their former work, and only a few were somewhat limited in athletic activities.

Subluxation of the shoulder

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Problems of shoulder subluxation are discussed with reference to a follow-up study of 17 patients treated by operation between 1969 and 1982. The patients were ten males and seven females ranging in age from 17 to 37 years, with subluxation of the dominant arm in 13 and of the non-dominant arm in four. The mean follow-up period was 3 years and 4 months.

The corrective operation was a modified Bankart procedure or capsulorrhaphy.

The subluxation mostly occurred at forced lateral rotation/abduction of the dominant arm, in 11 cases during athletic activities. All patients showed a positive apprehension test.

Results, graded according to C. Rowe, were: excellent in 55 per cent, good in 18 per cent, fair in 18 per cent and poor in 9 per cent of the athletes; in non-athletes, they were excellent in 50 per cent, good in 0 per cent, fair in 16 per cent and poor in 34 per cent. The mean loss of lateral rotation in 90 degrees abduction was 4 degrees (range: 0 degrees to 24 degrees). Eight of the 11 athletes had resumed athletic activities at the same level 2 years after the operation; three were active at a lower level.

Fourteen persons (82 per cent) would in retrospect again have submitted to the operation; 18 per cent would not have done so.

Conclusion: this capsulorrhaphy gave good results in 73 per cent of cases, especially if performed on the dominant side in athletes.

Treatment of anterior habitual shoulder dislocation by reefing of the subscapular muscle and Weber's derotational osteotomy

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Treatment of habitual shoulder dislocation aims at restoring a stable shoulder while retaining as much function as possible. Subscapular muscle reefing alone causes limitation of lateral rotation. This deficit is abolished by a derotational osteotomy. The insertion of the subscapular muscle is severed via the anterior approach. A derotational osteotomy is performed at an angle of 25 degrees; stable fixation is ensured with an AO shoulder-plate, with functional postoperative treatment. The degree of subscapular muscle reefing depends on the derotation.

Between 1974 and 1982, 61 patients were thus treated. Fifty-nine were considered for follow-up and 56 were actually seen (57 shoulders). The mean follow-up period was 4.5 years (minimum: 2 years).

Specific radiological examination revealed a humeral head defect in 49 and a dubious humeral head defect in seven cases. No general postoperative complications occurred. In one case a dubiously infected haematoma was excochleated. Partial atrophy of the deltoid muscle occurred in one case. Redislocation occurred in two cases, continuous subluxation in one, voluntary subluxation in one, and habitual dislocation in one case. Complete functional recovery was observed in 42 cases; slight limitation of function (up to 15 degrees) occurred in seven cases, and functional limitation of 15 degrees or more in another seven (arthrodesis in one). Subjective loss of strength was reported for 11 shoulders (ten on the non-dominant side).

Treatment of habitual shoulder dislocation by Weber's derotational osteotomy

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Between 1970 and 1981, 68 patients (71 shoulders) were treated by Weber's derotational osteotomy. Sixty-five patients (68 shoulders) were available for a follow-up after an average of 5 years and 9 months (range: 2–11 years). The mean age at operation was 26 years and 7 months. The average period in hospital was 7 days for the derotational osteotomy and 3 days for removal of the osteosynthesis material some 16 months after the first operation.

The follow-up showed that six patients (six shoulders) had developed redislocation. In one patient this redislocation was habitual and required re-operation. The remaining five showed incidental redislocation at least 2 years after the operation; none required re-operation.

Forty shoulders showed normal mobility; 28 showed limitation of mobility, which only one patient experienced as extremely inconvenient. Twenty-five patients had a mutilating scar, which required plastic surgery in three patients.

Treatment of recurrent anterior dislocation of the shoulder by the Bankart and Putti-Platt techniques

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A description is given of the operative treatment of recurrent anterior shoulder dislocation by a technique based on the procedures of Bankart and Putti-Platt.

The limitation of the lateral rotation of the humerus is critical. The medial capsule flap and the subscapularis muscle are shortened and sutured back to the head of the humerus so as to allow zero degrees of lateral rotation during the operation, without undue tension on the sutures.

Postoperative management is of utmost importance for an optimal result and a careful immobilisation and exercise programme is described. To ensure a cosmetically acceptable scar, the incision should be made from the coracoid process, curving slightly in the medial direction and ending in the skin-fold on the ventral side of the axilla. The wound is closed intra-cutaneously.

A follow-up study on 105 patients who had been operated, revealed that by this protocol the limitation of the lateral rotation in the majority of cases was less than 50%, which is not noticed by the patients. The recurrence rate was 4.8% after an average follow-up period of 5.5 years. Return to previous work and sport was influenced by the result of the operation in 8.3% and 35%, respectively. More than 80% of the patients were satisfied with the result of the operation.

Treatment of recurrent dislocation of the shoulder by the Bristow procedure

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A follow-up was performed on 44 patients who underwent a total of 47 Bristow operations for habitual anterior shoulder dislocation. The 47 shoulders included 32 with habitual dislocations and 15 with so-called spontaneous instability. The follow-up period averaged 3 years and 7 months (8 months to 9 years and 4 months).

No significant preoperative or postoperative complications were observed. No real recurrence of dislocation occurred. After the operation one patient in the habitual dislocation group showed objective instability. Two patients continued to complain of non-objective shoulder instability.

Satisfaction was expressed about 83 per cent of the shoulders, moderate satisfaction about five (10.6 per cent), dissatisfaction about three (6.3 per cent). The mean limitation of lateral rotation in 90 degrees abduction was 12 degrees.

Conclusion: the Bristow procedure is a simple, brief operation with few complications and a low recurrence rate; limitation of lateral rotation can be described as slight (average 12 degrees); results were good also in patients with spontaneous instability of the shoulder.

Comparison of the Bristow and Putti-Platt techniques for treatment of recurrent dislocation of the shoulder

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The results obtained with the Latarjet-Bristow procedure in the treatment of 36 shoulders with habitual dislocation were compared with those in 108 shoulders treated for the same indication by the

Bankart and/or Putti-Platt technique. Before operation the two groups did not differ significantly in indication, type of dislocation and composition.

The morbidity in the two groups differed appreciably: hospital period, period of immobilization and duration of physiotherapy were shorter in the Bristow group. Subjective functional recovery and duration of unfitness to work were both more favourable in the Bristow group. After a Bristow procedure, more patients were able to resume risky athletic activities than after an operation according to Bankart/Putti-Platt.

Although the mean limitation of lateral rotation at follow-up was less in the Bristow group, and the postoperative recurrence rate was lower, the ultimate subjective results were virtually equal in both groups.

The principal difference between the results of the two techniques therefore concerns morbidity, and to a lesser extent the recurrence rate, but not the ultimate subjective result.

Lateral clavicular fractures

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Modifying Neer's classification, we recognize three types of lateral clavicular fractures. Type I localized between the coracoclavicular ligament and the AC-joint is stable and can be treated conservatively. Type II is unstable due to the partial or total disruption of the coracoclavicular ligament. Type III is unstable due to the localisation just medially to the intact coracoclavicular ligament.

Four displacing forces are working on Type II and III fractures: A. The weight on the arm; B. The traction of the pectoralis major and minor as well as the latissimus dorsi muscles; C. The scapular ligaments may rotate and tilt the lateral fragment with movement of the arm; and D. The medial fragment is pulled backward and upward by the trapezius muscle.

This explains the high frequency of non-union with conservative treatment. Therefore Type II and III represent an indication for surgery. In Type III fractures osteosynthesis after open reduction is sufficient. In Type II fractures, in addition, cerclage wire around the coracoid protects the sutured ligament.

From 1975 to 1982, we operated on five Type II and III fractures. All healed without postoperative complications. In the same period we operated on five non-unions of the same fracture types, which had been treated conservatively in other hospitals.

Conservative treatment and osteosynthesis of proximal humeral fractures

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A follow-up was performed on 31 patients with a severe comminuted fracture of the proximal humerus and/or fracture dislocation. Three were treated by Neer's arthroplasty. Of the remaining 28, nine were treated conservatively and 19 by osteosynthesis. The fractures were classified as proposed by Neer. The mean age of the group treated conservatively was 68 years and 8 months, while that of the group treated by osteosynthesis was 53 years and 5 months. The follow-up period averaged 48 (12–98) months.

Conservative treatment consisted of functional treatment after a brief period of immobilization. Reduction under general anaesthesia was required in three cases. Osteosynthesis was performed with the aid of cerclage in 20, and with plate and screws in nine cases.

Results according to Neer's criteria were: excellent in one, moderate in two and poor in six cases in the conservative group. In the osteosynthesis group they were: excellent in four, good in five, moderate in two and poor in eight cases.

Avascular necrosis of the humeral head developed in six cases in the osteosynthesis group (in four patients with fracture dislocation and in two with a four-fragment fracture). The avascular necrosis as a rule did not develop until after some time.

Interposition of the tendon of the long head of biceps in fracture separation of the proximal humeral epiphysis

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In the vast majority of cases, fractures of the proximal humeral epiphyseal plate can be treated conservatively. The remarkable remodelling process following this injury is due to the fact that the proximal epiphysis contributes 80% to the longitudinal growth of the humerus.

Open reduction of these fractures is hardly ever necessary except on the rare occasion when the long head of the biceps becomes trapped at the fracture site.

In three cases (two girls, 13 and 14 years old and one 11-year-old boy) of fracture separation of the proximal humeral epiphysis, closed reduction failed. At operation, interposition of the tendon of the long head of the biceps and periosteum was found. All the fractures were Salter type II. After reduction the fractures were stabilised with two Kirschner-wires in two cases and with a Kirschner-wire and a cancellous bone screw in one case. Follow-up treatment was performed in a collar and cuff for 6 weeks, after which there was complete functional recovery.

Neer's arthroplasty in the treatment of proximal humeral fractures

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Ten patients (three in Amsterdam and seven in Leiden) with fractures of the humeral head were treated by Neer's arthroplasty. All cases involved four-fragment fractures (as classified according to Neer (1970)), including eight with and two without dislocation of the head.

The series consisted of seven women and three men ranging in age from 40 to 75 years (mean age 61 years and 7 months). The follow-up period averaged 2 years and 7 months (range from 6 months to 6 years and 11 months). The average interval between trauma and operation was 6 days and 6 h. In eight of the ten cases, the operation was performed within 3 days.

Results as assessed according to Neer were: excellent in one case, satisfactory in three cases, unsatisfactory in five cases, and failure in one case. Nine patients were subjectively satisfied; one continued to have pain. Six of the seven women were able to resume normal daily activities; two of the three men resumed their work.

Operation of congenital elevation of the scapula – a survey among Dutch orthopaedic surgeons

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In congenital elevation of the scapula, the literature available can make a choice of treatment confusing. There are differences in treatment methods and in evaluation of results. Data is often based on small numbers.

Four operative techniques prevail: proximal scapulectomy, Schrock's method, vertical scapula-osteotomy, and the Woodward procedure. In evaluation of the results of 180 patients treated by the quoted methods, the Woodward procedure appears to give a good functional and cosmetic result. This method is the most popular choice of orthopaedic surgeons in the Netherlands, as was demonstrated by a survey regarding the treatment of Sprengel's deformity.

Insufficient correction and neurovascular compression can be avoided by taking into account the typical dysplastic characteristics of the scapula, its position of rotation, the presence of abnormal connections between the scapula and the surrounding tissues and the association with other congenital anomalies in muscles, ribs and clavicles. Winging of the scapula should be regarded as a relative contraindication. Scar problems are limited by intracutaneous sutures.

In conclusion, the Woodward procedure by an osteotomy of the clavicle is the preferred method of choice in properly selected patients of 3–8 years of age with a mild to a moderate degree of elevation.

Treatment of Sprengel deformity by the Woodward operation

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From 1969 to 1983, 11 patients with Sprengel deformity underwent a Woodward operation (*J. Bone Joint Surg.* 1961). In 10 patients functional impairment and/or cosmetic appearance were the indication for surgery. In one patient, the lump in the neck hindered proper bracing for severe scoliosis.

The mean age at operation was 5.4 (range 3–12) years; follow-up was 5.2 (0.5–14) years. Cosmetic grading according to Cavendish (*J. Bone Joint Surg.* 1972) was pre-operative 2.5 (1–3). At follow-up, the mean grade was 0.9 (0–3).

Pre-operative active abduction (excluding one patient with full R.O.M.) was 105 (80–140°). The average gain in abduction was 35 (0–50°).

Complications: one patient sustained a complete but transient brachial palsy.

We believe that the Woodward operation is the treatment of choice and offers a considerable cosmetic and functional gain in cases of mild or moderate Sprengel deformity. Since the above-mentioned complication is well known in the literature and might be attributed to costoclavicular compression, we recommend combining the Woodward operation with a clavicular osteotomy, as recommended among others by Chung et al. (*Clin. Orthop.* 1976).