

TREATMENT OF UNSTABLE FRACTURES, DISLOCATIONS AND FRACTURE-DISLOCATIONS OF THE CERVICAL SPINE WITH SENEGAS PLATE FIXATION

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The results of the anterior approach to the cervical spine for the treatment of fractures and dislocations by arthrodesis and Senegas plate fixation are described. Twenty-two patients underwent a one- or two-level arthrodesis of the cervical spine. Their mean age was 42 years. The injuries were subdivided using the radiological classification described by Harris. In the group of patients who presented with a complete neurological deficit below the level of injury, there was only one patient who deteriorated. X ray examination 1 year after surgery showed fusion in 17 patients (100%). In contrast to some recent cadaveric and animal studies in which the anterior approach and fixation were found to be less stable than posterior fusion, our results obtained with this method are excellent, despite the fact that post-operative immobilization was limited. Problems with the anterior approach did not arise in these 22 patients. Alignment was always acceptable and fusion was achieved within one year in all cases.

Keywords : cervical spine ; dislocation ; fracture ; fracture-dislocation ; internal fixation.

Mots-clés : colonne cervicale ; fracture ; luxation ; fracture-luxation ; osteosynthèse.

INTRODUCTION

In this article we discuss the results of the anterior approach to the cervical spine for the treatment of fractures and dislocations by arthrodesis and Senegas plate fixation.

The anterior approach was first described in 1955 by Smith and Robinson (11), in 1956 by Dereymaker from Brussels and in 1961 by Cloward

(6). Subsequently the technique was discarded for 10 years. There has been a revival since 1970 when the first plate fixations were performed (table I).

Table I. — History

1955 Smith Robinson
1956 Dereymaker Cloward
1964 Bohler
1970 Orozco
1971 Tschern Senegas
1979 De Oliveira
1983 Gassmann Selvigson

PATIENTS AND METHODS

Twenty-two patients, 7 women and 15 men, with traumatic lesions, underwent a surgical intervention between May 1983 and July 1988 in our hospital. The mean age at the time of the accident was 41.9 years with a wide distribution over the various decades of life (17-91 years). The main causes of the accidents were trivial falls down stairs and traffic accidents (table II). The injuries were subdivided using the radiological classification described by Harris (8). Only the types encountered in our series are mentioned (tables III, IV). Flexion injuries, mainly of the C5-C6 region, were most common. Eight patients had no neurologic involvement, 8 patients were completely paralyzed below the site of

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injury and 6 patients presented with an incomplete tetraplegia.

None of our patients suffered multiple injuries, the associated lesions being of minor importance in the majority of cases (table V). The delay between trauma and surgery ranged from none to almost 6 months (average : 24 days). Two patients with unilateral facet joint dislocations are responsible for the high average figures, their lesions initially passed unrecognized and were only diagnosed and treated at a later stage when referred to our service. The 6 patients with an incomplete tetraplegia were operated on immediately.

Table II. — Cause

Traffic Accident 8
Sports 3
Home 9
Work 2

Table III. — Involved vertebrae

C3 : 1
C4 : 8
C5 : 16
C6 : 13
C7 : 4

Table IV. — Type of lesion
Radiological Harris classification

<i>Type I Flexion</i>	
A. Anterior subluxation :	6
B. Bilateral facet dislocation :	6
C. Flexion-teardrop :	3
<i>Type II Flexion rotation</i>	
A. Unilateral facet dislocation :	2
<i>Type III Vertical compression</i>	
A. Burst fracture :	3
<i>Type IV Hyperextension</i>	
A. Hyperextension-dislocation :	2

Table V. — Associated lesions

None :	11
Skull :	7
Abdomen :	1
Upper limbs :	1
Lower limbs :	3
(only 1 patient with 2 associated lesions)	

SURGICAL TECHNIQUE

The patient is placed in the supine position with skeletal traction. A left-sided transverse skin incision over the medial border of the sternocleidomastoid muscle is made. While the carotic pulse is palpated, the superficial layer of the deep cervical fascia is incised. The middle layer of the deep cervical fascia that encloses the omohyoid medial to the carotid sheath is divided, then the deep layers of the deep cervical fascia are divided (pretracheal and prevertebral fasciae overlying the longus colli muscle). After the muscles are reflected subperiosteally and laterally to the level of the uncovertebral joints, a needle placed in the discus can accurately locate the area of decompression with the use of the image intensifier (1, 2, 3, 4, 5, 6, 7, 10).

Depending on the lesion we performed a discectomy (10) or a corporectomy (1, 3, 6). A tricortical graft was intercalated and a plate was fixed with 4 screws (2, 7). The position was confirmed with the image intensifier.

In the 6 cases with incomplete tetraplegia the screws did not penetrate the posterior cortex. Fusion included one level in 16 patients and two levels in 6 patients (table VI). In one patient, a combined anterior and posterior fixation was performed. Postoperatively, a cervical collar was worn for an average of 3 months.

Table VI. — Level of fusion

C3-C4	: 1
C4-C5	: 5
C5-C6	: 6 (1 ant. + post. fusion)
C6-C7	: 4
C4-C5-C6	: 4
C5-C6-C7	: 2

RESULTS

An ascending tetraplegia (from C5 to C3) was found in one patient. This patient had an anterior and a posterior fixation. Hence, it is not proven that the anterior technique is responsible for this deterioration (table IX).



Fig. 1. — Fracture of the fifth cervical vertebra.

According to the Frankel Scale (table VIII), the neurologic status was improved in 5 patients, all of whom had surgery within the first 24 hours.

The most astonishing recovery was seen in a patient who fell from a horse. Initially he was classified in the Frankel A group (no motor or sensory function below the level of injury). He presented at the hospital with a complete tetraplegia due to spinal shock. The myelography revealed a traumatic disc lesion at the C3-C4 level. He underwent surgery immediately. After surgery and recuperation he had useful motor function and the presence of sensation (Frankel D group). The neurologic recovery was almost complete. The patient was probably in a phase of spinal shock, rather than true complete neurological compromise. The vertebral fusion was stable after 6 months.

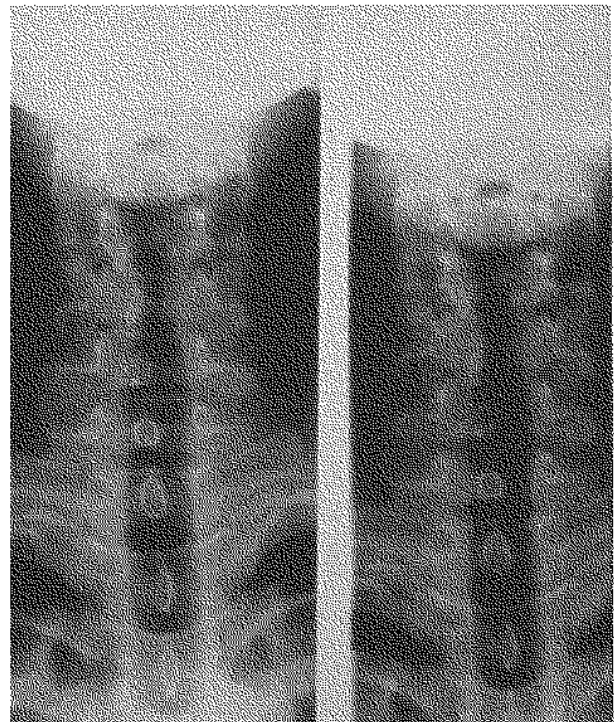


Fig. 2. — Fusion of level C4-C5 and level C5-C6.

The alignment on postoperative x rays 4 weeks after surgery was good in 14 patients (82%). Two patients showed a slight anterolisthesis and 1 patient showed a slight angulation.

Overall there were 4 deaths : three of Frankel group A and one of Frankel group B. They died between 1 and 30 days postoperatively due to cardiac arrest. Their ages ranged from 65 to 91 years.

FOLLOW-UP 1 YEAR POSTOPERATIVELY

As mentioned before, 4 patients died, and one patient was lost to follow-up ; hence 17 patients were re-examined.

Ten patients were free from any discomfort or pain (59%). Two patients had no pain but experienced a sense of heaviness. One patient, who also had a psychiatric history, had pain with daily activities.

Pain and discomfort on looking over the shoulder was mentioned by 3 patients, whereas another patient had pain in the interscapular and lumbar region but no cervical pain.

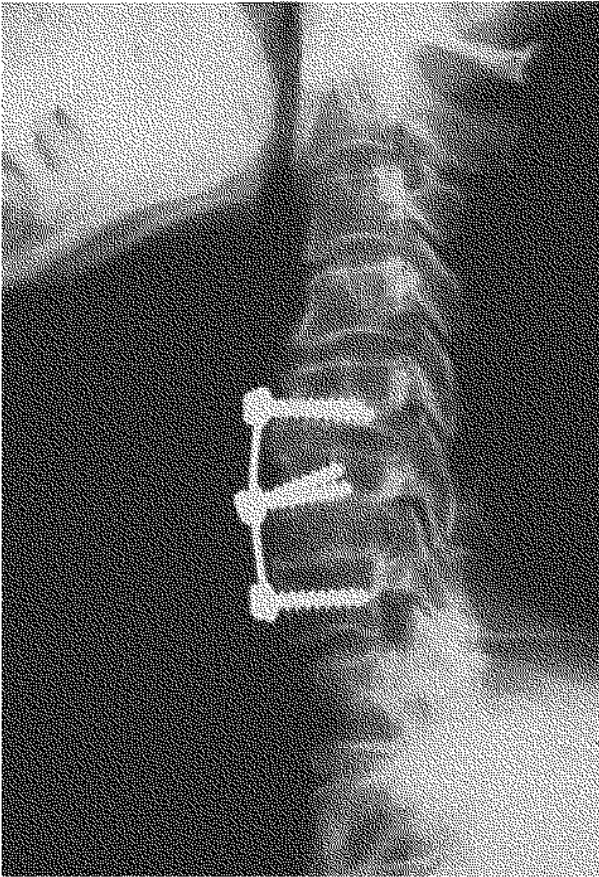


Fig. 3. — Fracture of the sixth cervical vertebra.

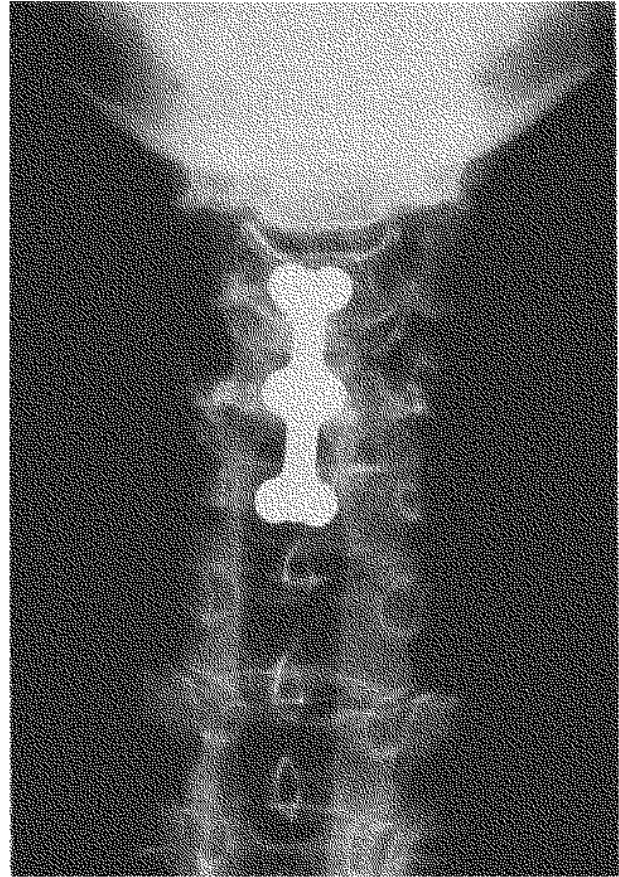


Fig. 4. — Fusion of level C5-C6 and level C6-C7.

Anteflexion was limited in only 1 patient. Retroflexion was slightly limited in 2 patients and limited in 1 patient. Lateroflexion was normal in 9 patients, slightly limited in 1 patient, one-third limited in 4 patients and half limited in 3 patients. There was a right-left side difference in lateroflexion in 3 patients. The rotation was normal in 11 patients (65%). In 4 patients the rotation was limited. Two patients had a better rotation in one direction compared to the other. The forward flexion and the retroflexion were almost normal in all patients. Rotation and lateroflexion were somewhat more restricted; the patients frequently experienced discomfort and even pain on looking behind them.

X ray examination 1 year after surgery showed fusion in 17 patients (100%). One screw had

loosened but did not present any problem. Radiographic alignment remains acceptable in all cases.

There were no neurologic lesions in 11 patients. Three had an incomplete lesion and 4 patients had a complete tetraplegia (table VIII).

CONCLUSION

In the group of patients who presented with a complete neurological deficit below the level of injury, there was only one patient who deteriorated. Eighty percent improved or had the same neurological status after surgery. Eighty percent of the patients who presented with an incomplete tetraplegia improved neurologically by surgery. All of the patients without neurological problems had surgical stabilization without neurological

complications (table VII, VIII and IX). The four deaths were either older than 65 years or/and polytraumatized.

In contrast to some recent cadaveric and animal studies in which the anterior approach and fixation were found to be less stable than posterior fusion, our results obtained with this method are excellent, despite the fact that postoperative immobilization was limited.

Problems with the anterior approach did not arise in these 22 patients. Alignment was always acceptable and fusion was achieved within one year in all cases. Nevertheless one should consider the advantages and risks of this procedure (tables X and XI). Subjectively, most patients were satisfied with the outcome and preserved acceptable mobility. The anterior approach to the cervical spine may therefore be considered an acceptable alternative for the treatment of fractures and dislocations by arthrodesis and Senegas plate fixation.

Table VII. — Frankel scale

A : no motor or sensory function below level of injury
B : sensation but no motor function
C : motor function present but useless
D : motor function present and useful
E : normal motor and sensory function

Table VIII. — Frankel scale evolution

Preoperative	Follow-up
A	A
B	B
C	C
D	D
E	E

Table IX. — Frankel scale evolution

A C5	A C3	l pt
A	+	3
A	A	3
A	D	1
B	+	1
B	D	1
C	E	2
D	D	1
D	E	1
E	E	8

Table X. — Advantages

Low complication rate
Good alignment
Solid consolidation
Early mobilization
Acceptable subjective parameters

Table XI. — Risks

Myelopathy
Radiculopathy
Cerebral infarction
Horner's syndrome
Recurrent laryngeal nerve palsy
Vascular lesions
Dysphagia

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SAMENVATTING

J. MOERMAN, A. HARTH, I. VAN TRIMPONT, D. UYTTENDAELE, R. VERDONK, H. CLAESSENS, S. VERBEKE. Behandeling van onstabiele fracturen ; luxaties en luxatie-fracturen in de cervicale wervelkolom door middel van Senegas plaatfixatie.

In dit artikel worden de resultaten besproken van de anterieure arthrodese bij luxaties en/of fracturen van de cervicale zuil volgens de techniek van Senegas. Deze studie handelt over 22 patiënten met een gemiddelde leeftijd van 42 jaar. De verschillende letsels zijn ingedeeld volgens de radiologische classificatie van Harris. Van de patiënten die een volledig neurologisch deficiet vertoonden is er één patiënt die verslechterde. Eén jaar na de ingreep werden alle patiënten aan een röntgenologisch onderzoek onderworpen. Dit onderzoek toonde beenderige fusie aan in 100% der gevallen.

In tegenstelling tot enkele recente cadaverstudies en diermodellen, waarbij werd aangetoond dat de biomechanische sterkte van de anterieure fixatie kleiner zou zijn dan die van de posterieure, werden toch uitstekende resultaten met deze techniek bekomen en dit ondanks gelimiteerde postoperatieve immobilisatie.

De techniek volgens Senegas is betrouwbaar voor de behandeling van fractuur-luxaties van de cervicale wervelkolom.

RÉSUMÉ

J. MOERMAN, A. HARTH, I. VAN TRIMPONT, D. UYTTENDAELE, R. VERDONK, H. CLAESSENS, S. VERBEKE. Traitement des fractures, luxations et fractures-luxations instables de la colonne cervicale à l'aide de plaques de Senegas.

Les résultats de l'arthrodèse antérieure par allogreffe et fixation avec plaque de Senegas sont analysés. Il s'agit de vingt-deux patients d'un âge moyen de quarante-deux ans. Les différentes lésions sont classifiées d'après les critères radiologiques de Harris. Un seul patient a présenté une détérioration neurologique. Un an après l'intervention tous les patients ont été radiographiés, tous ont une fusion osseuse stable.

Certaines études expérimentales et biomécaniques ont démontré que la résistance des fixations antérieures est moindre que celle des fixations postérieures. Dans notre série nous avons obtenu des résultats excellents malgré une immobilisation postopératoire limitée.

Selon notre expérience, la technique de Senegas est fiable dans le traitement des luxations et fractures de la colonne cervicale.