COTREL - DUBOUSSET INSTRUMENTATION IN FRACTURES OF THE THORACIC AND LUMBAR SPINE

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In the last fifteen years CT Scans and improved knowledge on spinal biomechanics have clearly shown that how poor results, closed reduction, and brace treatment may give in the treatment of the traumatic injuries of thoracolumbar spine.

In this study we are presenting 12 thoracolumbar spinal fractures treating with C-D instrumentation and posterior fusion at first orthopedic and traumatology clinic of Ankara Social Security hospital, from December 1988 to December 1989. one of them was Til, three T12, three LI, two L2, and one L3 burst fractures, one of them was L3-4 dislocation, and the other one L3 compression fracture.

CDl applies more stabilityl and rigidity to created thoracolumbar spinal fractures than the other system while immobilizing less segments. This study suggest that CDl should be employed for posterior stabilization of thoracolumbar spinal fractures with important advantages and provided better correction of thoracic and lumbar postural angles.

CDl for stabilization of traumatic lesions of the spine follows 3 main principles, different from others;

a. Short instrumentation

b. The possibility of trans pediculer fixation by screw

c. additional reduction device which is an asymelrical clinder and its special ancillary instrument to wrap it around the rod.

In the recent year the concept of unstable vertebra has improved especially with the Denis's three spinal column concept. (1,2) In the last fifteen years, CT scans and improved knowledge on spinal biomechanics have clearly shown how poor results might be given in the treatment of traumatic injuries of the thoracolumbar spine with closed reduction and bracing. (3)

The goal of surgical treatment of spinal fractures are reduction and stabilization to permit early ambulation. In addition, preservation of spinal deformity and mobil segments, protection of neural elements and restoration of normal lumbar lordosis have another importance in lumbar fractures. Conventional methods of treatment such as Harrington, Luque and Harrington SSI techniques require fixation of more than 4 segment and are inadequate to restore normal lumbar contour. (4)

Various system and techniques have been evoked to improve fixation and stability. Problems associated with the commonly used Harrington system have been torsional instability poor resistance to bending and hook dislodgemcnt. (5,6,7)

Though CDl is popularised in the treatment of scoliosis the technique is also available for the fractures of thoracolumbar spine. CDl is ideal for treatment of thoracolumbar fractures because of the wide rods, feasibility of hook placement, possibility of rectangular configuration, stiffnes to rotational forces and performance of a very rigid internal fixation. (8)

In this study, we report the short term results of 12 thoracolumbar fracture treated by CDL

PATIENTS AND METHODS

In this study we arc presenting 12 thoracolumbar fractures treated by CDl and posterior fusion at Ankara Social Security Hospital, in the First Clinics of Orthopaedic and Traumatic Surgery from December of 1988 to December of 1989. Two of the patients were female (16,7%), 10 of them were male (83,3%). Avarage age of the patients was 34,5 (Range 15-49).

Preoperative Evaluation :

After admitting to our clinic all the patinets had detailed physical and neuorgical examination, routine laboratory tests, radiologic examinations and CT scanning.

All the patients except one (91,7%) were referred to a hospital in the same day. The remaning one was admitted to the hospital 7 days after the injury.

6 of the patients (50%) had made their first admittance to our hospital and among the remaining 6, one was referred to our hospital in 2 days, one in 4 days and one in 33 days after the operation. The remaining

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3 had their treatment in other hospitals but because they were not satisfied with their treatment, they were admitted to our hospital. Their time of admittances to our hospital were 3 months, 12 months and 29 months later respectively. All of the 3 patients were admitted to our hospital with severe pain. From the anamnesis we learned that 4 had flexion and rotation type, 7 had axial compression type and I had flexion distraction type injuries.

4 of the patients (33,3 %) had neurological deficits, prcoperatively. Two had total bilateral L-4,L-5,S-1, one had left L-4, L-5 total and S-l parsial aksonal degeneration and one had total bilateral L-2, L-3 denervation lesion. We also had same Elcctromyographic results. Remaining 8 patients didn't have any neurologic deficits. (66,7%).

In the radiological examinations we assessed the type and location of the fracture. Injuries were classified according to Dennis. Besides, sagital,index was also mcassurcd for all patients. (9) Sagital contour is pivotal in predicting progressive deformity, since the normal sagittal contour of the spine is essential to maximize resistance to loading. Significant scgmental distruplion of this sagittal contour will compromise spine resistance and demands reduction. The sagittal index is defined as the angle measured between the two intact end plates which encompass the fractured mobile segment. At the thoracolumbar junction, the sagittal index is normally measured 0 degree. (9)

Because of this reason we measured the sagittal index of every fractured vertebra and also the sagittal index of thoracolumbar juction in order to presume that a progressive postural deformity would take place or not. We also calculated the compression ratio of every fractured vertebra from lateral X-rays.

We performed CT scanning for every patient in order to asses the medullary canal and details of the fracture.

Surgical Techniques and Postoperative Follop-up

After being planned prcoperatively, one of the techniques proposed by Dr.Cotrel was performed in all of the patient to supply correction and internal fixation.

We performed 3 level instrumentation in 5 patients (41,7%); 4 level instrumentation in 6 patients (50%) and 7 level instrumentation in 1 patient (8,3%). We performed fixation by means of hooks in 11 patients and pedicular screws in patient.

Except 2 all of the patients were operated under induced hypotensive anaesthesia. Two patients who were operated under normotensivc anaesthesia had 5 units of intraopcrative blood transfusion while the other 10 had only 1 unit of intraoperative transfusion.

Nincof the patients had posterior fusion with autogeneous bone grafts while the remaining 3 had posterior fusion with bank grafts. None of the patients had intraopcrative or early postoperative complications. All patiens were mobilized in bad on the first postoperative day. On the second postoperative day patients without neurologic deficit were encouraged to walk. The two patients with partial defict was allowed to walk with appropriate orthosis on the third postop day. The remaining two total paraplegia were sent to a rehabilitation center 15 days after the operation.

Patients were called for a review on the 1st, 3rd, 6th and 12th post operative months. They were assessed clinically and radiolgically for the loss of correction. Their sagittal index and TLJA were measured and compared with the prcopcrativc ones.

The criteria for a satisfactory result included:

1) Neurological stabilization or improvement

2) Restoration and maintanance of normal spinal contour

3) Integrity of the stabilization device and

4) Achievement of a solid fusion mass.

RESULTS

According to the Denis's classification we had 10 (83.1%) burst fractures, 1(8.3%) L3-L4 dislocation with flexion distraction fracture and 1(8.3 %) moderate anterior compression fracture. Among the 10 burst fracture one was at Tl 1, three was at T12, three was at LI, two was at L2 and one was at L3 level. One compression fracture was at L3 and one flexion distraction fracture was at L4 level. One of these patients had lamincctomia and one had fibula fracture.

Average prcopcrative compression rate was 56.2 % (range 35-75%). Average prcopcrative TLJA was 19.9 degrees (range 0-32 degress). Average prcoperative sagittal index was 24.9 degrees (range 5-44).

Postopcralively 11 of the patients had normal spinal contour and correction. In the patient with fracture dislocation continuity of the vertebral column was provided partially with open reduction.

Postoperativcly average correction obtained was 9.4 degrees % (range 0-22 degrees). Rale of the corrcction was 52.4 % (range 0-66.7 %).

Average postoperative correction of sagittal index was 11.2 (range 0-22). Rate was 58.1 % (range 0-81.3 %). Patients without neurologic complication prcoper-

atively didn't have any neurologic complication postoperativcly. One patient with partial dcncrvation returned to normal postoperativcly. Of the other 3 patients neurologic findings did not improve.

Nine of the patients (75 *%)* returned to their work within 60 days. The patient with unilateral neurologic involvement returned to an easier work in 90 days. Two patients with paraplegia returned to rehabilitation clinic and had the complication of dccubilus ulcers.

In all of the patients, there was a solid fusion mass after at least six months had passed after the operation. There was no correction loss and no change in TLJ Angles in the controls except one. In the patient in whom there was loss of correction, the sagittal index had been found to reach 80 degrees in the 3rd months control. In this patient there was a burst fracture in the LI vertebra, during the operation the plan was not performed properly. The hooks had been placed in fractured vertebrae though it had been planed to place in the L2 vertebrae. We also planned to prolong instrumentation with the lep of connection tubes in this patient. For this reason we have begun to take a rontgengoram during the operation to find the place of the fractured vertebrae, recently.

DISCUSSION

The principles of management of unstable thoracolumbar spinal fractures arc: adequate reduction in both the AP and sagittal planes, decompression of the spinal canal either obtained by means of reduction or anterior routes maintenance of reduction by suitable internal fixation device and meticulous fusion. (8)

Among the many surgical procedures proposed the best known is Harrington's technique (double rodding), formaly used in scoliosis surgery, although Harrington himself had already realized that it could be specifically employed also for stabilizing spinal fractures. However especially in some parliculcr kind of injuries, like burst and flexion-distraction fractures, even Harrington's technique is not always able to garantee for definitely stable fixation without plaster body jacket's use.(3)

A cast or polypropylene brace is required postoperativcly for a period ranging from three to six months. (10)

Because of the inadequacy in maintaining lomber lordosis Harrington technique isn't well suited to the fractures for this reason. It also is not resistant to rotational or axial forces, therefore can not prevent spinal deformity in the long follow up period. (3,5,6,7,8,11) Even well done Harrington rods have a significant postoperative loosening and pscudoartrosis rate as high as 13 %. (12)

In a paraplegic individual skin break-down with sores arc common under a brace or cast. In a paraplegic patient is also important to mobilize that patient rapidly so that they can begin a rehabilitative program. (10)

In addition to this cast application for a long period makes social and economic problems for the patients. Also the complications of rod breakage or hook insufficincy is frequently encountered (13,14,15,16).

Segmental spinal wiring (SSW) and it's many modifications were associated to Harrington rods for the sake of increasing in number the constraints between spine and rods. This resource dividing up the vectors, reduces their single load. Nevertheless the segmental spinal wiring is not strong enough to withstand torsional phenomena, mainly responsible for fixation failure. (3,17)

However CD rods appear to be a better system for spine stabilization because of it's greater rigidity and more rapid patient mobilization without postoperative support and it is morcadaptablc than the Harrington system in maintaining the lordosis of lomber fractures. Using more hooks attachment sites with this system along with the interlinking dual rods may result in improved long term healing with a lower pseudoartrosis and loosening rate. (17,18,19,20,21,22,23)

In this study we performed CD technique to 12 patients with thoracolumbar fractures. In the postoperative period no neurologic deficit occured in addition to this one patient with partial neurologic deficit healed completely. No complications occured except one paraplegic patient who had wound dehiscance and treated with seconder suluration. Loss of correction didn't occur in any patients. There were serious corrections in TLJA and sagittal index and loss of these corrections weren't seen in early period. According to these results we concluded thai CDI performed a rigid internal fixation and adequate correction of anatomic postur.

We didn't use any cast or brace postoperatively. Thus, no complications about immobilization did occur. Patients without neurologic deficit returned to their work within 60 days.

Two level vertebral fixation with screws seemed to be adequate in the early postoperative period and this was harmonious with the reports of Suk et al (1988) and Gircesan ct al (1989) (4.18). On the other hand 3 or 4 level fixation with the use of hooks and rods seemed to be adequate in preventing loss of correction

and pseudoarthrosis.

We believe that CDI provides an alternative method in the treatment of spianl fractures. It achieves satisfactory reduction and provides an excellent fixation. A satisfactory alignment has been maintained in this short follow up period. All patients were allowed to participate in early rehabilitations, particullary significantly for paraplegic patients.

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