THE EFFECTS OF ANTERIOR VERTEBRAL GRAFTING AFTER CORPECTOMY AND ANTERIOR SPINAL FIXATION*

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ABSTRACT :

In this study, the strength of iliac and costal bone grafts in fresh calf models with corpectomy, against to axial loading, was studied. Biomechanic test was applied to 12 calf models which are between thoracal 11 and lumbar 3. Intact vertebrae, corpectomy + AASS (Anterior Alıcı Spinal System), corpectomy + iliac graft + AASS, and corpectomy + costal graft + AASS models were subjected to axial loading for 20 mm/minute. The average compressive load in unprocessed models was measured as 12800 N ± 57.73, In corpectomy + AASS models was as 3200 N ± 57.73, in corpectomy + iliac graft + AASS models as 8800 N ± 115.5, and in corpectomy + costal graft + AASS models as 9600 N ± 115.5. At the end of the statistical analysis, was no difference between iliac and costal bone grafts applications was observed, but intact model rigidity was not reached to.

Key words: *Corporectomy, spine fixation, anterior, anterior fusion.*

INTRODUCTION

Anterior approach which is used in the treatment of infiltrative neoplasms and infections is also preferred to be used in the treatment of burst fractures by many clinicians. In reconstruction and stabilization, anterior fixation with bone graft is necessary in order to be strong to axial loading of middle and anterior columns. After total or partial corpectomy, iliac, costal or fibular bone grafts are used as a strut.

In this study the strength of iliac and costal graft for axial loading in the calve spine models with corpectomy was experienced.

MATERIALS AND METHODS

In this study, 12 newly slaughtered calf (at the average age of 2) spines (similar in size) were used. Preserving bone, discs and spinal ligaments, the spines between thoracal 11 and lumbar 3 were taken out. Three specimens were left intact and corpectomy was applied to others at L1. Iliac graft and AASS were performed on 3 of them, costal graft and AASS on the other three. The remaining spinal models with corpectomy were fixed with only AASS (Fig. 1). Axial compression force which was 20 mm/minute ramp loading was applied to the experimental models in the Haunsfield universal materials testing device, at 17°C (Fig. 2). Resistance to compression and compressional shortening were measured.

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RESULTS

1. The average compressive load in intact models was measured as 12800 N ± 57.73 and the shortening as 17 mm (Fig. 3).

2. The average comprressive load in models with corpectomy + AASS was determined as 3200 N±57.73 and the shortening as 17 mm.

3. The average compressive load in models with corpectomy + iliac graft + AASS was 8800 N ± 115.5 and the shortening was 20 mm.

4. The average compressive load in models with corpectomy + costal graft + and AASS was established as 9600 N ± 115.5 and the shortening as 19 mm.

Differences were observed among groups when Kruskal Wallis variance test was applied. Then Tukey's test was applied to the average values of groups. While there was a significant difference between the first and the remaining groups, no difference between the third and forth groups was determined ($kw=10.38$; $p<0.05$).

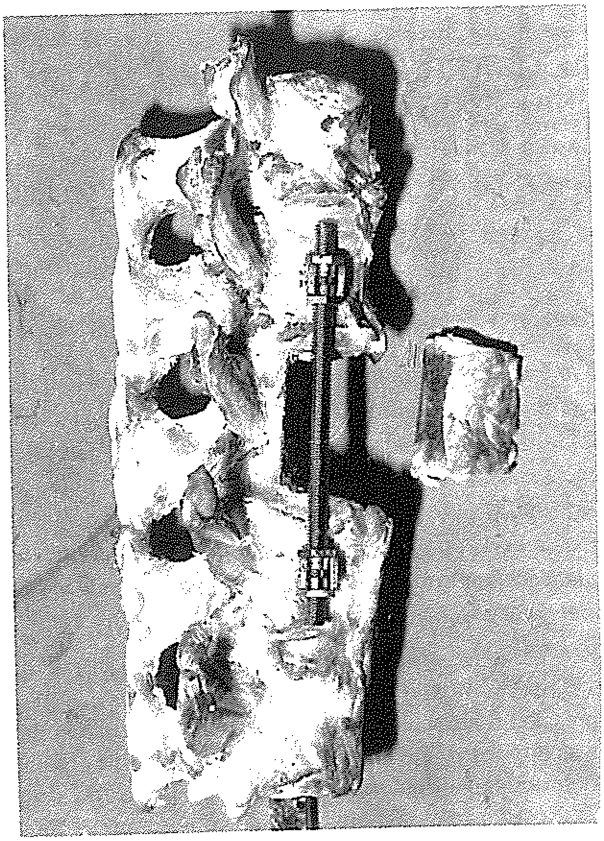

Figure 1. Corpectomy model fixed with AASS.

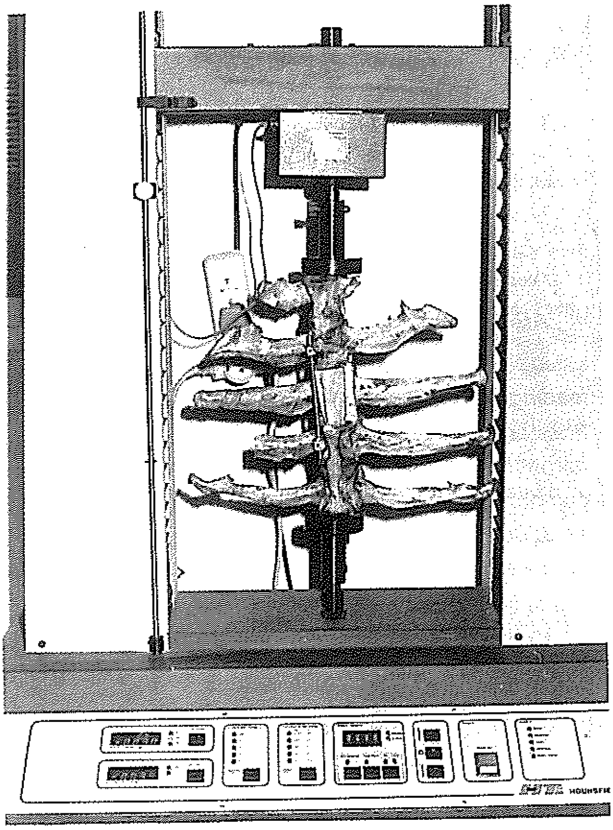

Figure 2. Photograph showing experimental model in the Hounsfild universal compression device.

DISCUSSION

Spinal reconstruction surgery after corpectomy provides axial, torsional and flexural rigidity. Burst fractures and infiltrative neoplasm mostly cause incomplete neurological deficits (4, 10, 13).

In burst fractures decompression is achieved indirectly; that is, with ligamentotaxis of posterior access (2, 3). In this fractures, because of the penetration of corpus with intervertebral disc, delay of union of the fracture will develop and in this way, it will load to late device failure of the spinal system (8).

Hence, many authors offer grafting and anterior fixation after corpectomy (6, 8). Corpectomy, as in after trauma, is also performed in infiltrative neoplasms for elective decompression. Iliac graft, costal or fibular autogenous bone grafts are used for fusion and increasing instability (6, 8, 13).

In an experimental study carried out on iliac graft, fibular graft, and FDPDM (Freeze-dried partially demineralized microperfored) femoral bone, it has been found that, FDPDM femoral bone graft is the strongest to axial loading when compared with fibula and fibula compared with iliac graft (12).

Methylmethacrylate can also be used after corpectomy. From the stand point of biomachanic, that after corpectomy, methylmethacrylate Harrington-rod system, Kaneda anterior device or Cotrel-Dubousset Instrument provide stability has been reported (5).

In a study performed on dogs, it has been reported that, in a long time period, after cyclic loading while rigidity of methylmethacrylate was gradually decreasing, rigidity of the bone graft increased (14).

Petty et al. concluded that when methylmethacrylate and various orthopedic implants used in dogs were compared from the point of deep wound infections, infections risk was higher in methylmethacrylate used samples (11). If decreasing stability and high infection risk are considered, the use of methylmethacrylate is suggested to be limited to salvage procedures as in metastatic tumors (11, 14).

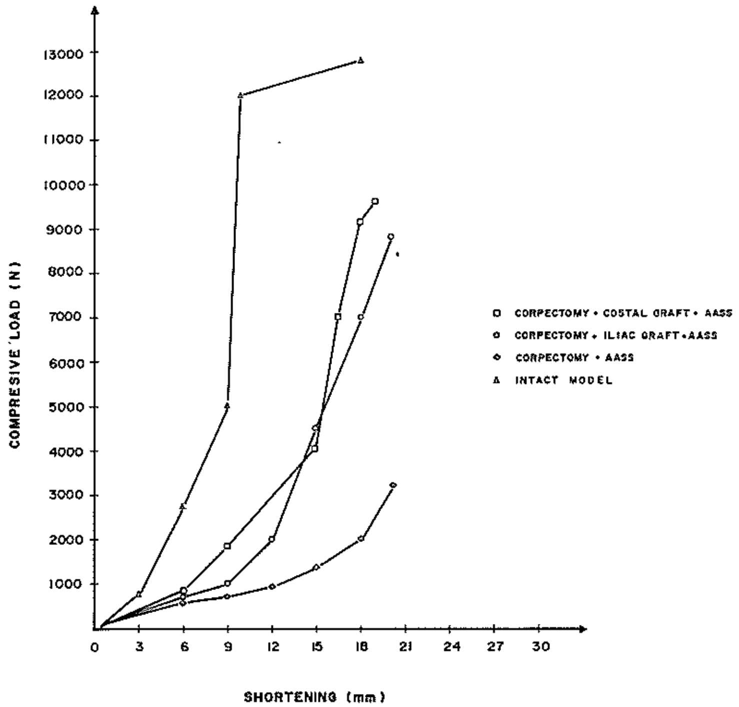

Figure 3a. The load-deformation curves of experimental models

Iliac and costal autogenous bone graft are used frequently.

In the comparison of iliac and costal grafts used in corpectomy and AASS models, no difference against to axial loading was established. It was also observed that they were not as strong as intact models. These results can be reserved for acute stability restoration instead of one with long duration. When considering anatomic differences of calve vertebrae from human vertebrae, clinical modification of this study may cause debates. Although calve corpectomized vertebral model is nonphysiologic for evaluating anterior instability, many investigators use these models in in-vitro biomechanical studies (1, 7, 12).

In the light of the results above, we think that costal graft which requires no additional approach can be used safely in the necessitated corpectomy processes.

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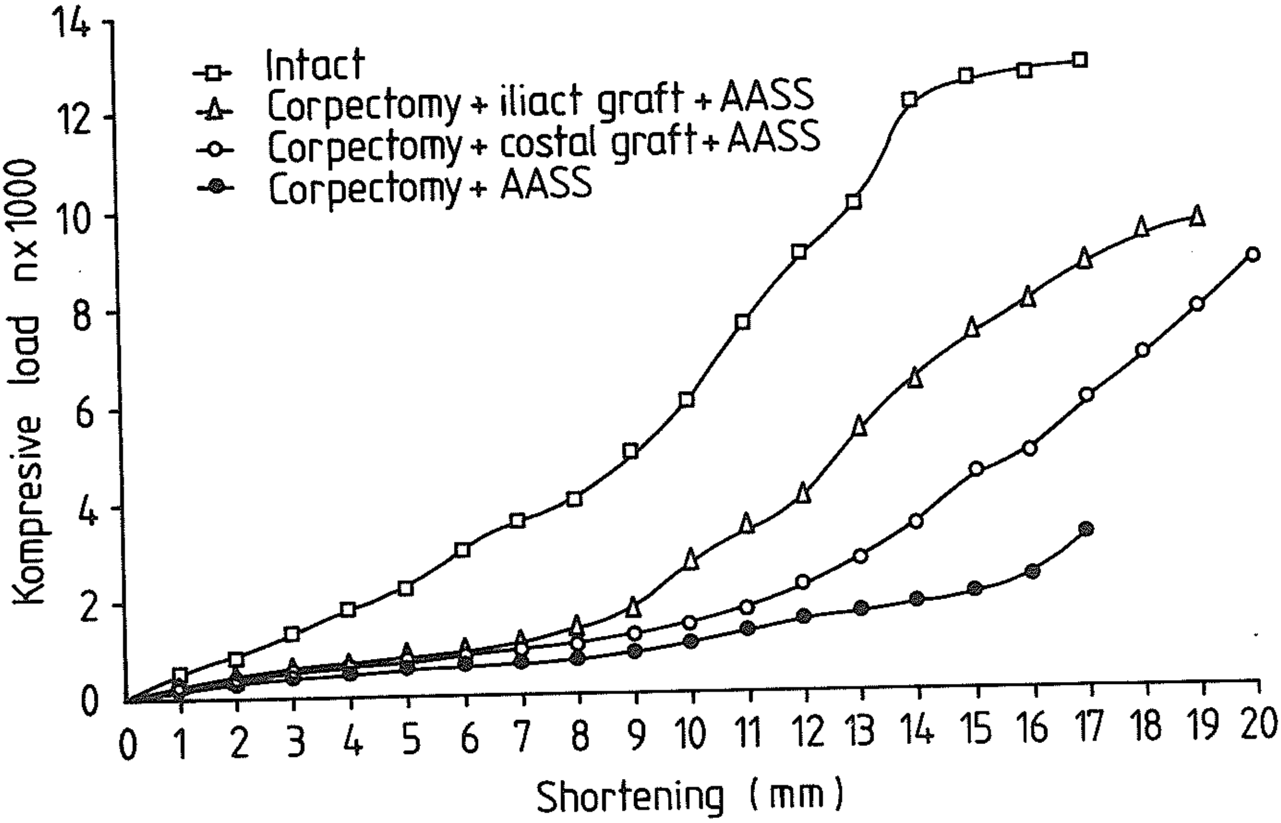

Figure 3b. The load-deformation curves of experimental models

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POSTOPERATIVE LUMBAR PSEUDOMENINGOCELE

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SUMMARY :

One of the rare complications following lumbar disc surgery is development of pseudomeningocele. In this paper we report a case of pseudomeningocele at the level of L5-S1, diagnosed by MRI following to previous lumbar disc herniation operations. Subsequent operative closure of the dural defect resulted in reversal of her neurological symptoms.

Key words : Lumbar disc surgery, pseudomeningocele, complications.

INTRODUCTION

Surgical excision of a herniated lumbar disc is one of the most common operations performed by neurosurgeons. The complications of these operations are rare and sporadic but due to the greater number of operations are seen not infrequently. Among them postoperative pseudomeningocele is quite rare. In this situation there is a cerebrospinal fluid (CSF) filled sac secondary to a dural tear during operations, which slowly grows in the paravertebral tissues (13, 14, 16). In the more rare form a defect of both the dura mater and arachnoid exists, thus the CSF accumulates in the soft tissues and it is later delimited by a fibrous reaction (1, 2, 9, 11, 12). The traction on the nerve roots by the sac or the entrapment of a nerve root within a dural defect in the pseudomeningocele wall may cause back pain and radicular symtoms (5). Surgical treatment should be performed in symptomatic cases. The following case report describes MRI findings and surgical repare of such a case.

Case Report:

A 38 year old woman presented with severe low back pain, left sciatic pain and headache increasing with movement. Seven months prior to admission she had an L4-L5 left partial hemilaminectomy for a ruptured L4-L5 disc at another hospital. Because of the recurrence of the same complaints a CT of the lumbar spine was done six months after the operation; this revealed recurrent disc herniation at the same site. Her complaints relieved for two weeks duration after the second operation.

On admission her examination revealed a flocculent cutaneous mass at the site of the laminectomy incision. Straight leg raising was limited bilaterally at 45 degrees. There was no neurological deficit. MRI of the lumbar spine showed a 3.5 cm x 5 cm x 5.5 cm cystic extradural lesion which has same intensity with CSF in the left posterior paraspinal region of the L5-S1 level and a communication between this cystic lesion and the subarachnoid space (Fig. 1a). A postoperative pseudomeningocele was considered. At operation, the previous operative scar was explored and a subcutaneous pseudomeningocele containing clear CSF was identified. There was a communication between the pseudomeningocele and the subarachnoid space through a 5 mm defect in the lateral aspect of the dural sac between L4 and L5 roots. The duramater was repaired with interrupted sutures and suture line was sealed with fibrin glue. In the postoperative period her complaints gradually subsided. One month later, control MRI showed a remnant pseudomeningocele cavity (Fig. 1b). At follow up 6 months later, the patient was asymptomatic and there wasn't any sign of pseudomeningocele on the MRI (Fig. 1c).

DISCUSSION

Postoperative pseudomeningocele as a very rare complication with an incidence of 0.07-2%, was first reported by Hyndman and Gerber in 1946 (4, 6, 17). Postlaminectomy pseudomeningocele may result from a tear in the dura and arachnoid causing leakage of CSF into the soft tissue. At the beginning most of the CSF is absorbed, but with progression of fibrous reaction the CSF begins to accumulate underneath or within the muscle masses of the paraspinal musculature (1, 3, 9, 13). Signs and symptoms probably due to strangulation or entrapment of a nerve root within the pseudomeningocele. Compression of a nerve root by enlarging pseudomeningocele with valve mechanism

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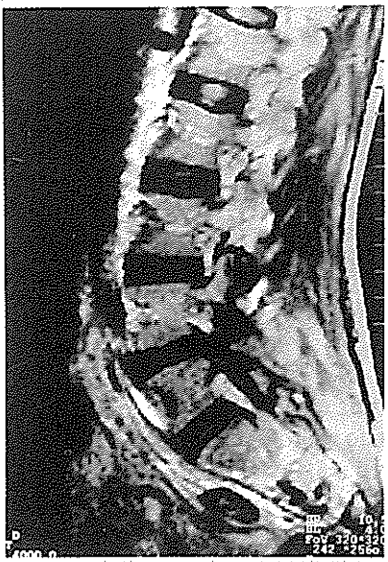

Figure 1-A. Preoperative T2 weighted sagittal lumbar MRI

Figure 1-B. One month postoperative T2 weighted sagittal MRI

Figure 1-C. Six months postoperative T2 weighted sagittal MRI

may also cause lumbar pain and/or radicular signs as we have observed in our case (11, 15). The interval between laminectomy and forning of a symptomatic pseudomeningocele as depending on size and location of the dural tear varies from weeks to years. The most common complaint is recurrence of the lumbar pain, radicular pain is less frequent, muscle weakness and sphincteric troubles are so rare (9). Pseudomeningocele formation should be suspected in patients who had headaches increasing particularly with efforts after the surgical procedure.

The diagnosis can be achieved by CT scanning or MRI of the lumbar spine. MRI has several advantages over other diagnostic procedures such as entails no risk of ionizing radiation, gives multiplanar images, it is noninvasive and provides superior soft tissue imaging with much information about fluid characteristics and gives detailed information about the sac and its relationship with soft tissue and spinal canal (2, 8).

Surgical treatment should be considered for symtomatic lesions. It was reported that removal of the sac itself is not sufficent (15). Purpose of the treatment is the repair of the dural tear to prevent the recurrence of the pseudomeningocele (7, 10, 11, 13, 14). The dural tear should be closed in a water-tight fashion with a dural graft if needed. Fibrin glue may also be helpful.

It is not true that every dural tearing will lead to the formation of a pseudomeningocele but patients known with dural tearing should be followed up closely and if radicular symptoms and/or back pain recurres then pseudomeningocele formation should be kept in mind in the differential diagnosis.

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