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SPINAL FUSION BY FIXATION WITH A BILAMINAR ILIAC BONE GRAFT WEDGED ON THE SPINOUS PROCESSES IN THE SAGITTAL PLANE

By

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In September 1960 *Besa* described a new method for spinal fusion. Without knowledge of *Besa's* work the present author used the same method for the first time in May 1959. The impulse to develop the operation was given by the desire to get patients out of bed early after operative fusion of two lumbar vertebrae without endangering the result. Since the first operation the author has used the method in twenty-one cases. During the same period about two hundred patients were operated on for a protruded intervertebral disc by the author. This means that the indications for the method in question have been considered limited.

OPERATIVE TECHNIQUE

Before the transplant is taken from the ilium the spinous processes and the laminae of the vertebrae which are to be fused are exposed. If exposure of nerve roots and intervertebral discs is indicated in the particular case, this is done before the processes and laminae are prepared for application of the transplants. The cortex is partly removed from the spinous processes and from the posterior aspects of the laminae. All soft tissues are removed from the space between the two spinous processes.

From the middle part of the iliac crest a piece of bone comprising about four centimeters of the entire thickness of the crest is taken with a chisel. A suitable size of the iliac graft is usually 4×3 centimeters (Figure 1). From both ends of the bilaminar graft the spongy

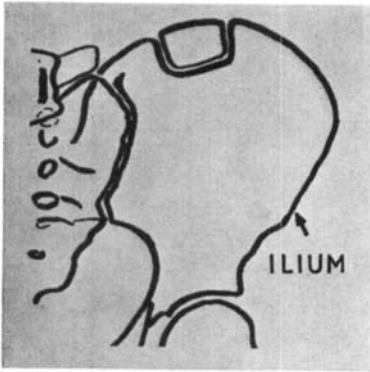


Figure 1.

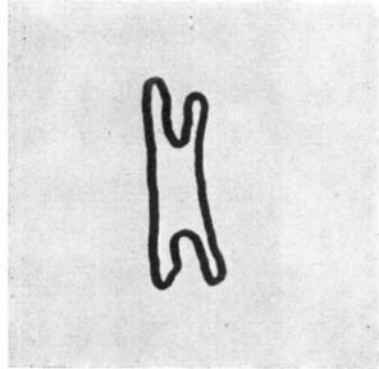


Figure 2.

Figure 1. Schematic drawing of the area from which the bilaminar iliac bone graft is taken.

Figure 2. Schematic drawing of the bilaminar graft from the ends of which the spongy bone and the middle part of the cortex of the crest have been removed.

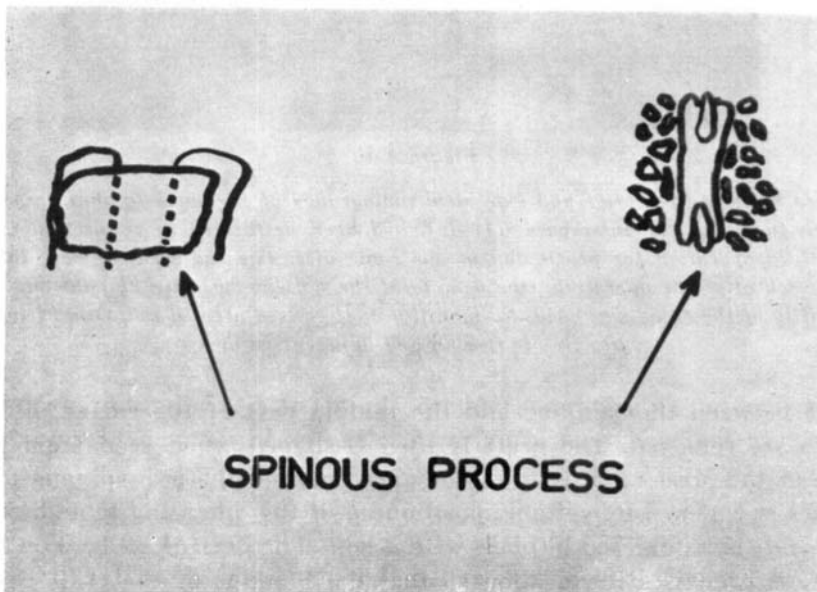


Figure 3. Schematic drawing of the manner in which the massive bone graft is wedged on the spinous processes. Chips of iliac bone are implanted between the laminae on both sides of the massive graft.

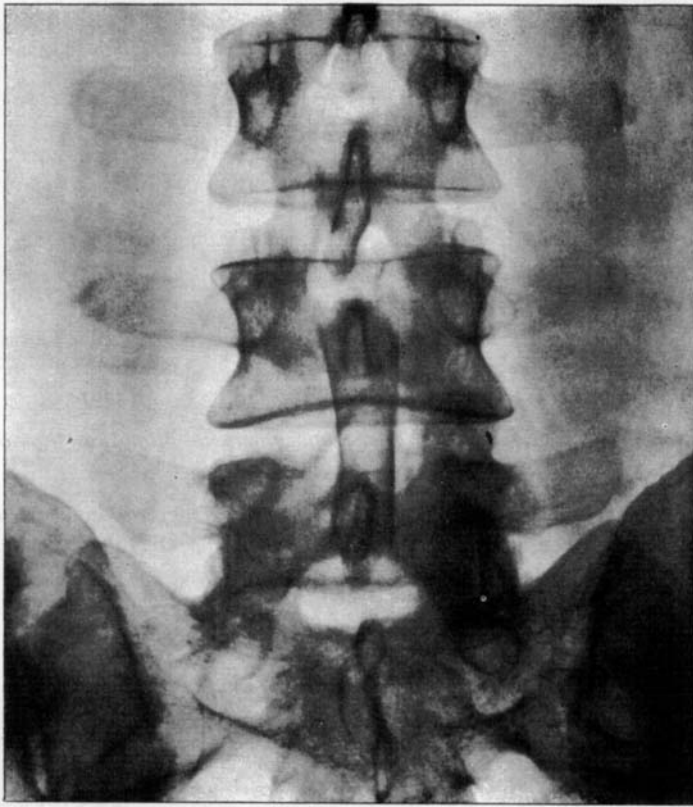


Figure 4 A.

Figure 4. Antero-posterior and side view radiographs of the same lumbar spine in which fusion of the interspace LIV-LV had been performed in connection with the third operation for protrusion of the same disc. The radiographs were taken one week after the operation. One year later the patient was free of pain and the mobility of the spine was good. No mobility of the fused area in radiographs taken in extreme flexion and hyperextension.

bone between the laminae and the middle part of the cortex of the crest are removed. The graft is then H-shaped when seen from the side of the crest (Figure 2). The space between the two spinous processes is widened by suitable positioning of the operating table before the graft is hammered in place with a bolt. The graft is wedged on the spinous processes in question so that the laminae of the graft cover the lateral surfaces of the processes (Figure 3).

The spondylodesis is completed by implantation of bone chips from the ilium lateral to the massive graft (Figure 3). If the dura has been

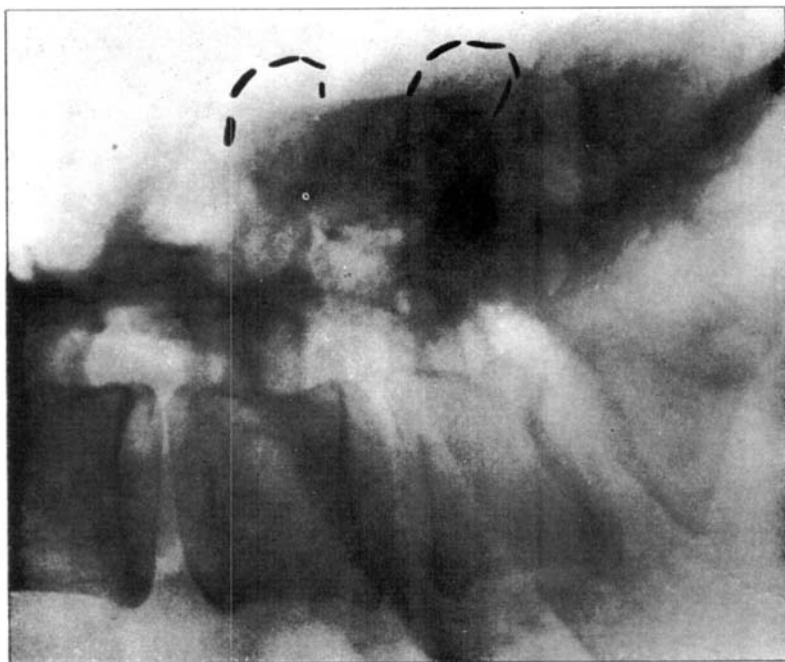


Figure 4 B.

exposed on one side, chips are implanted only on the contralateral side. In the presacral interspace the method can be used only when the sacral crest is well developed. The muscles covering the defect in the iliac crest should be sutured with non-adsorbable material to prevent formation of hernia (cf. *Bosworth 1955*).

MATERIAL

In nine cases fusion of two lumbar vertebrae was performed when operating for the removal of a recurrent disc protrusion. (Figure 4). In four cases spondylodesis was carried out for chronic backache from severe degeneration of one single lumbar disc. In three cases of sciatica the signs of degeneration of the disc was considered too severe to indicate simple removal of the protruded mass, and fusion was performed at the same operation (Figure 5). In four cases the operation was carried out for chronic backache with localized tenderness in one interspace but without roentgenological signs of severe degeneration of the disc. In one case the indication for operation was residual sequels of tuberculosis in two vertebrae.

The oldest patient in the series was fifty-five years old. A girl aged eighteen with healed tuberculosis of the vertebrae L III-L IV was the only patient under twenty years. In eleven patients the operation was carried out in the interspace L IV-L V, in eight between L V and the sacrum, and in one between L III and L IV.

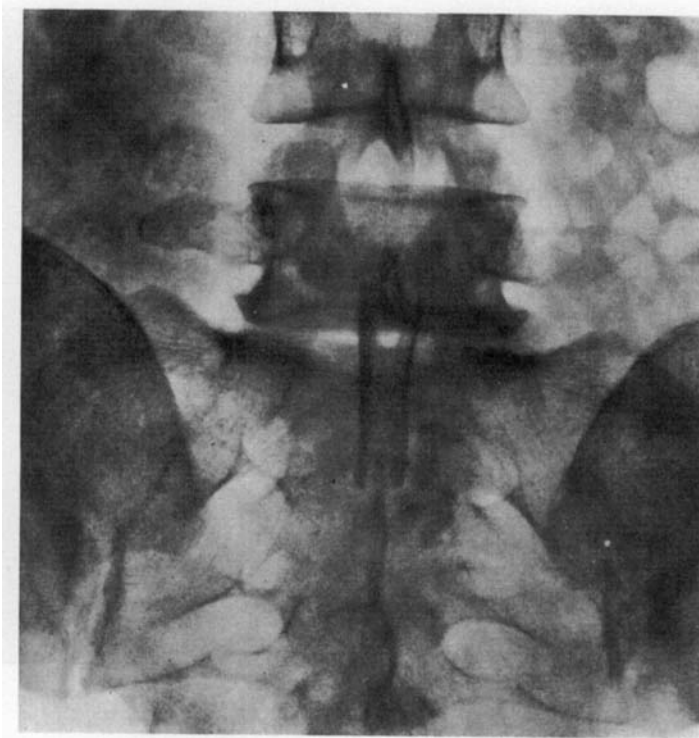


Figure 5. Antero-posterior radiograph of a spine in which fusion of the fifth lumbar vertebra to the sacrum had been carried out. The radiograph was taken five days after the operation. Six months later the patient was free of pain and the mobility of the spine was good. Radiographs in bent position indicated solid fusion.

One patient was operated on twice, first in the interspace L IV-L V and later in the presacral interspace.

Ten patients were out of bed on the first or second day after the operation, six on the third to sixth day and four on the twelfth to sixteenth day. After healing of the wound the patients were allowed to live a normal life but were recommended to avoid work in a bent position and avoid sudden bending of the spine. Systematic exercise of extension and flexion of the back was started four months after the operation. At the same time fusion was tested in twenty patients by taking side view radiographs in extreme hyperextension and extreme flexion of the back.

In eighteen cases side view bending radiographs showed no mobility in the fused interspace. In two cases the presence of a pseudarthrosis could be proved. In both these cases it had been necessary to remove the articular processes on one side in the interspace L IV-L V. Three patients had persistent backache in spite of radiography suggesting fusion. In these cases there were strong reasons to suspect a psychogenic basis for the complaints. In sixteen cases good mobility of the spine

was proved at examination six months after operation and thirteen patients could be followed up for more than one year.

DISCUSSION

In 1948 *Cleveland, Bosworth & Thompson* pointed out that "One should avoid covering any greater number of spinal intervals than are absolutely essential in performing a fusion at the lumbosacral juncture, but the fusion should always extend to and include the sacrum." (p. 311). This principle partly explains why the present author has used the method described in only twenty-one cases in eight years. However, there are cases in which recurrent disc protrusion in the L IV-L V interspace makes fusion of the vertebrae highly desirable and the L V-S disc shows only slight or no signs of degeneration. To carry out a fusion of two interspaces in these cases would mean protracted recumbency because the author has not been convinced that immobilisation for several weeks can be avoided after fusion of two interspaces in the lumbar spine without endangering the result of the operation.

If our patients can be allowed to be out of bed a few days after operative fusion of the vertebrae L IV-V without too great a risk of pseudarthrosis, there are reasons for carrying out such a fusion more often than we have been inclined to do. The disadvantage of prolonged recumbency after orthopaedic operations in adult patients is today well recognized. The experience gained with the method described seems to indicate that it makes it possible to avoid a long period of recumbency after fusion of one single interspace in the lumbar spine.

The indications for spinal fusion in this series correspond to those defined by *Howorth* in 1964.

SUMMARY

In 1960 *Besa* described a new method of spinal fusion by fixation with a bilaminar H-shaped iliac bone graft wedged on the spinous processes in the sagittal plane. Without knowledge of *Besa's* work the present author used the same method for fusion of one single lumbar interspace in May 1959. The operation has been carried out by the author in twenty-one selected cases. It seems to allow early mobilisation of the patient without too great a risk of pseudarthrosis and it is recommended when fusion of one lumbar interspace is indicated. For fusion of the fifth lumbar vertebra to the sacrum, the method can be used only if the sacral crest is well developed.

RESUME

En 1960 *Besa* a décrit une nouvelle méthode de fusion vertébrale par fixation au moyen d'une greffe osseuse iliaque bilaminaire en forme de H, enfoncée au milieu des processus vertébrales en le plan sagittal. Sans avoir eu connaissance de l'ouvrage de *Besa*, le présent auteur a eu recours à la même méthode, en mai 1959 pour établir la fusion entre deux vertèbres lombaires lorsqu'il s'agissait d'un seul espace intervertébral. L'opération a été pratiquée ensuite par l'auteur dans vingt et un cas sélectionnés. Elle semble permettre la mobilisation rapide du malade sans grand danger de pseudarthrose et elle est recommandée lorsqu'il d'un seul espace intervertébral lombaire. Pour la fusion de la 5ème vertèbre lombaire au sacrum, la méthode ne peut être utilisée que si la crête sacrée est bien développée.

ZUSAMMENFASSUNG

Im Jahre 1960 hat *Besa* eine neue Methode beschrieben, mit der eine Spondylodese mit einem H-förmigen Transplantat vom Ilium, das die beiden Knochenplatten des Darmbeins umfasst und in der Sagittalebene auf die Dornvorsätze der Wirbeln festgekeilt wird.

Ohne Vorwissen von der Arbeit von *Besa* hat der Verfasser diese Methode für die Spondylodese von zwei Lendenwirbeln seit Mai 1959 angewandt. Die Operation ist vom Verfasser in einundzwanzig ausgewählten Fällen angewandt worden. Die Methode scheint eine frühe Mobilisation der Patienten zu erlauben ohne ein zu grosses Risiko für Pseudarthrosenbildung. Sie wird rekommen diert wenn eine Spondylodese von zwei Lendenwirbeln indiziert ist.

Für eine Spondylodese zwischen der fünften Lendenwirbel und dem Kreuzbein kann die Methode benützt werden nur wenn die Crista Sacri gut entwickelt ist.

REFERENCES

- Besa, A. S. (1961) The Use of the Iliac Crest as a full Thickness Graft in Spinal Fusion (a new method). Proc. eighth Congr. Soc. Internat. Chir. Orthop. Traumatol New York September 4-9, 1960, Brussels, p 770.
- Bosworth, D. M. (1955) Repair of Herniae through Iliac-Crest Defects, *J. Bone Jt Surg.* 37-A, 1069.
- Cleveland, M., Bosworth, D. M. & Thompson, F. R. (1948) Pseudarthrosis in the Lumbo-sacral Spine. *J. Bone Jt Surg.* 30-A, 302.
- Howorth, B. (1964) Low Backache and Sciatica: Results of Surgical Treatment. Part I. Spine Fusion only. *J. Bone Jt Surg.* 46-A, 1485.