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TECHNICAL NOTE

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The 'MW' sacropelvic construct: an enhanced fixation of the lumbosacral junction in neuromuscular pelvic obliquity

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Abstract Fixation to the lumbosacral spine to correct pelvic obliquity in neuromuscular scoliosis has always remained a surgical challenge. The strongest fixation of the lumbosacral junction has been achieved with either a Galveston technique with rods or screws or with iliosacral screws. We have devised a new fixation system, in which iliosacral screws are combined with iliac screws. This is made possible by using the AO Universal Spine System with side opening hooks above and below the iliosacral screws and iliac screws below it. The whole sacropelvis is thus encompassed by a maximum width (MW) fixation, which gives an 'M' appearance on the pelvic radiographs and a 'W' appearance in the axial plane. We report on our surgical technique and the early results where such a technique was used. We feel that this new means of fixation (by combining the strongest fixation systems) is extremely solid and should be included in the wide armamentarium of sacropelvic fixation.

Key words Scoliosis · Surgical procedures · Arthrodesis

Introduction

Fixation to the lumbosacral spine has always remained a surgical challenge. The large variety of sacral or pelvic fixation devices clearly demonstrates the problem.

Allen and Ferguson were the first to report on their experience of the Galveston technique, where rods are inserted into the iliac wings above the sciatic notch [1].

Dubousset reported on his iliosacral screws technique to correct pelvic obliquity [3]. Screws of 7 mm are inserted from the iliac wing into the S1 pedicle at an angle of 45°–60°. Medial orientation of the S1 pedicle screws is known for increased pull-out strength, making the iliosacral screws a strong means of fixation [7]. More recently, some authors have used screws as iliac posts instead of the Galveston rods [2]. We ourselves have reported on a modification of the Galveston technique in Duchenne scoliosis, where lumbopelvic fixation is achieved with S1 pedicle screws and the rods are inserted in a horizontal fashion into the iliac wings [5]. However, in severe neuromuscular spastic scoliosis, the need for a strong fixation to the sacropelvis made us opt to use a combination of iliosacral screws and iliac screws inserted in a Galveston fashion.

Materials and methods

Surgical technique

Instrumentation of the scoliotic curve is done classically with either hooks, screws, or sublaminar wires. In our technique, iliosacral screws are inserted using Cotrel-Dubousset recommendations (using K wires and cannulated 7-mm screws). However, in

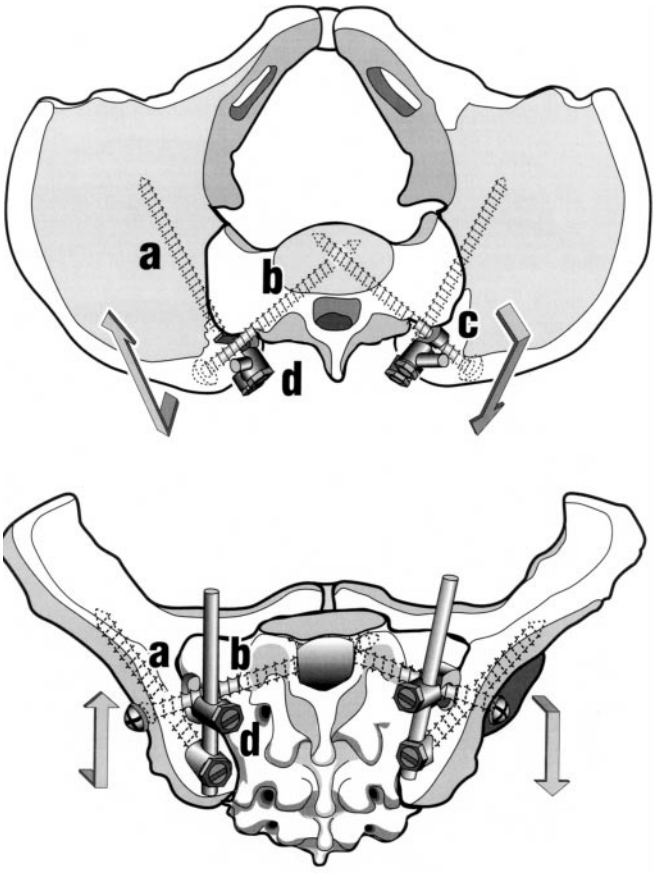

Fig. 1 Top and rear view of the MW (maximum width) fixation system. The 7-mm iliosacral screws (*b*) are inserted from the iliac wings into the first sacral pedicle at an angle of 45°. The iliac screws (*a*) are inserted in a Galveston fashion 1.5–2 cm below them. The rod is then connected to a laminar hook directed either downwards (*c*) or upwards (*d*) sitting on the iliosacral screws. The distal end of the rod is then connected to side opening iliac screws (6 or 7 mm in diameter). The fixation of the rod to the hooks and screws is made easier thanks to the ability of the hooks to slide along the iliosacral screws and also the offset opening of the implants. The top view of the pelvis shows a W appearance of the construct. The correction of pelvic obliquity can then be achieved through cantilever and compresssion or distraction (*arrows*) of this very rigid assembly

order to avoid penetration of the screws into the spinal canal, we deliberately remove the L5-S1 ligamentum flavum, perform if necessary a small laminotomy, and retract the S1 nerve roots medially. This way we have visualisation or direct palpatory control of the S1 pedicle, making screw insertion easy. We therefore do not routinely perform x-rays, which are always difficult to interpret at this level. An iliosacral screw of appropriate length (usually 60, 70, or even 80 mm long) is inserted on each side. A laminar hook on the side of the higher hemipelvis is inserted above the iliosacral screw, a laminar hook is inserted below the iliosacral screw of the lower hemipelvis. At this point the choice between a right- or left-side opening laminar hook is crucial, as the rod will need to be connected to the iliac post screw 1–2 cm lower down (Fig. 1). The use of the Univeral Spine System (USS; Synthes Paoli, USA) allows a possible offset of the hook or screw on the rod of up to 4 mm, as the implants are all side opening. Then with a blunt pedicle feeler (always enough in these osteoporotic neuromuscular iliac wings) the path for a regular side opening AOUSS 6- or 7-mm screw is made in the iliac wing. The entry point is 1.5–2 cm below the iliosacral screw in the width of the posterosuperior iliac spine, which is partially rongeured. The direction is parallel to the sciatic notch and 2 cm above it and perpendicular to the future rod. The screw is then inserted until its side opening is aligned with the laminar hook sitting on the iliosacral screw. The side opening can be turned 180° to match the opening of the hook, making the connection easier. Once the iliosacral screw and the iliac screw are inserted, the rods can be fitted in the side opening of both the hook and the screw. The correction is then done through a combination of compression and distraction at the lumbosacral level. A crosslink in distraction achieves further stability.

Case report

A 21-year-old spastic quadriplegic patient presented with severe pelvic obliquity and progressive kyphoscoliosis (Fig. 2). Treatment consisted of posterior spine fusion from T2 to the sacropelvis (Fig. 2C). Stainless steel rods from the USS were used and connected to 7-mm iliosacral screws, iliac post screws were inserted in a divergent fashion in the iliac wings, compression was applied on the lower pelvis side, distraction was then applied on the higher side of the pelvis. Then compression or distraction was applied between the iliosacral screws and the iliac screws to secure the montage. A crosslink system was then inserted in distraction. Postoperative radiographs showed the ‘M’ appearance of the instrumentation in the pelvis (Fig. 2C). An axial drawing shows the ‘W’ appearance of the fixation system in the other plane (Fig. 1).

Discussion

Fixation to the sacropelvis can be achieved by various means. It has been proven that the strongest fixations in the sacropelvis are achieved with the Isola Galveston technique, the Isola iliac screw, and the iliosacral screw [6]. By combining these different techniques in a simple construct we feel we have designed a very strong sacropelvic fixation to correct pelvic obliquity. The lack of bulky connectors leaves room for the decortication and the fusion of the sacrum. The Jackson and McManus fixation [4] is enhanced with the iliac butressing, but the locations of the rods are in our opinion too medial to correct pelvic obliquity, which requires a large moment arm and lateral bony purchase. The assembly of our construct is made easy by using hooks above or below the iliosacral screws, which can glide sideways when we insert the sacral post screw; the configuration of the laminar hooks and the screws, allowing for a possible 4-mm offset when set in an opposite fashion on the rod, adds another feature for easy insertion. We have used this system in four cases of neuromuscular scoliosis and each time achieved a very strong fixation of the sacropelvis and an excellent correction of the pelvic obliquity.

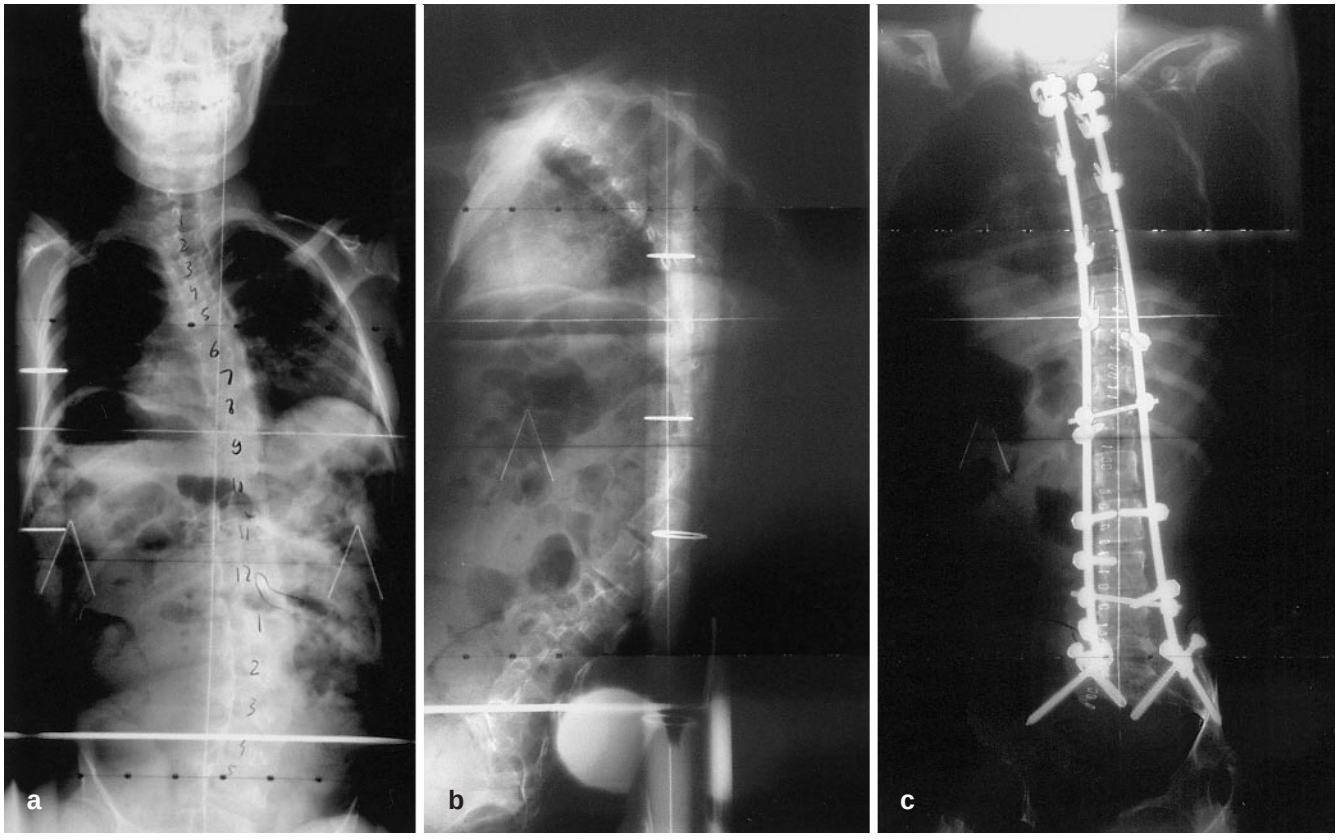

Fig. 2 **A, B** A 21-year-old spastic quadriplegic with severe kyphoscoliosis and pelvic obliquity. In the sitting position the Cobb angle is measured at 45° and the pelvic obliquity at 23°. An MW fixation has been performed at the sacropelvis level. **C** Postoperative postero-anterior radiograph shows satisfactory correction with excellent correction of the Cobb angle and no residual pelvic obliquity. The sacropelvic fixation has the appearance of an M

Conclusion

We termed this new means of fixation 'MW' fixation, because it appeared on the radiographs as an M, and on the axial reconstruction as a W. 'MW' stands also for 'maximum width'. This system allows compression on the lower side of the pelvis and distraction on the higher side, provided hooks or pedicle screws are used in the lumbar or thoracolumbar spine. The correction of pelvic obliquity is therefore enhanced compared to that achieved by classic Galveston fixation, where only sublaminar wires are used and only cantilever correction is possible. This method of fixation has to our knowledge not been reported previously. We believe that it should be included in the armamentarium of sacropelvis fixation in severe neuromuscular curves with pelvic obliquity.

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