Int J Clin Exp Med 2018;11(2):1278-1284
www.ijcem.com /ISSN:1940-5901/IJCEM0063093

Case Report

Dislocation and screws pull-out after application of an Isobar TTL dynamic stabilisation system at L2/3 in a patient with a previous posterior fusion from L4 to S1

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Received August 5, 2017; Accepted November 23, 2017; Epub February 15, 2018; Published February 28, 2018

Abstract: Dislocation and screw pull-out after the application of an Isobar TTL are rarely reported in previous studies. A 48-year-old male patient was diagnosed with L4-L5 tuberculosis and received posterior debridement surgery with instrumentation; however, 15 months after his first surgery the patient suffered from severe intervertebral disc herniation at L2/3. At this time the patient underwent his second surgery: the nucleus pulposus of L2/3 was removed and the Isobar TTL system was applied at L2/3. Six months after his second surgery the patient strained his back and, returned to our hospital. The lumbar X-rays showed the dislocation of L2/3 and screw pull-outs in the Isobar TTL implant. Then the patient received his third surgery: the Isobar TTL was removed, the spinous process and lamina of L3 along with the intervertebral disc at L2/3 were resected, porous nano-hydroxyapatite/polyamide 66 (n-HA/PA66) composite was inserted at L2/3, cement reinforced pedicle screws were used, and autogenous bone combined with artificial bone was implanted on the surface of the lamina from L2 to S1 for fusion. In conclusion, selection of an appropriate patient is important when using the Isobar TTL system. The lamina should not be resected too much, the facet joints should not be violated, and pedicle screw adjustment should also be avoided in its application. The angle between the screw and rod should be appropriate so that it avoids strength concentration on the pedicles and screws which may lead to instrumental complications. The real causes remain unclear at present, and therefore future biomechanical and clinical studies are needed.

Keywords: Dislocation, screw pull-out, isobar TTL, lumbar spine, complication

Introduction

Dynamic stabilisation of the lumbar spine has been used more widely in recent years due to its potential advantages: provision of adequate stability to restore normal segmental kinematics, greater physiological load transmission, and the reduction of the acceleration of adjacent segment degeneration [1]. Posterior dynamic stabilisation (PDS) system devices can be classified into three main categories: posterior inter-spinous devices; pedicle-based dynamic rod devices, and total facet replacement systems. The Isobar TTL dynamic stabilisation system (Isobar TTL, Scient'x, Bretonneux, France) is a new pedicle-based dynamic rod device which is aimed at decreasing the load on each intervertebral disc and improving clinical results by avoiding some adverse effects caused by fusion [2] (**Figure 1**). The Isobar TTL has been reported to be an effective method with which to treat lumbar degenerative disease given the selection of suitable surgical candidates [3-5]. Dislocation and screw pull-out after the application of an Isobar TTL are rarely reported in previous studies. Considering the paucity of knowledge of this area, we presented the special case of a successful revision surgery for the treatment of dislocation and screw pull-out after the application of an Isobar TTL at L2/3 in a patient with a previous posterior fusion from L4 to S1. In addition, we also tried to discuss the causes of such a complication so as to share our experience with other spinal surgeons.

Case report

The patient provided informed consent for the publication of his clinical and radiological data.

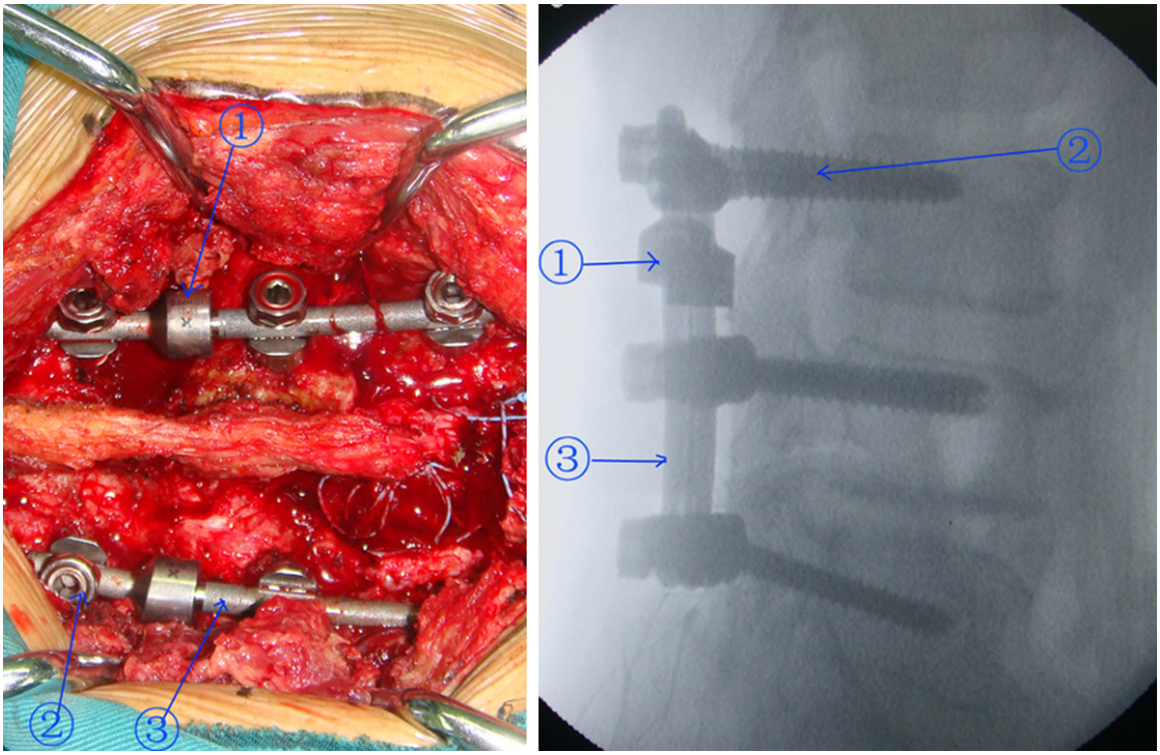

Figure 1. Images of the Isobar TTL Semi-Rigid Rod System and post-operative lateral X-rays. (① The dynamic component (damper element); ② The titanium alloy pedicle screw; ③ Connecting rod).

This case report was approved by Medical Ethics Committee of West China Hospital, Sichuan University.

A 48-year-old male patient presented to our hospital in January, 2014 with a history of right foot dorsal pain and weakness of the left foot over a 9 month period. After physical, biochemical, and radiological examinations, he was diagnosed as 1) L4-L5 spinal tuberculosis, 2) L5 spondylolysis, and 3) Intervertebral disc herniation at L2/3, L4/5, and L5/S1. After a pre-operative discussion in our department, the patient received a posterior debridement surgery of lumbar spinal tuberculosis with instrumentation of cage and screw rod system. After surgery, the patient was prescribed an anti-tuberculosis drug treatment regime for 18 months. The symptoms experienced by the patient were relieved by three months after surgery. Twelve months post-operative anterior-posterior, lateral, flexion, and extension X-rays, and computed tomography (CT) three-dimensional reconstruction images, showed an accurate positioning of the implant, the stability of the lumbar spine, and bony fusion from L4-S1 (**Figure 2**). However, 15 months after posterior debridement surgery of lumbar spinal tuberculosis the patient suffered from serious weakness of, and numbness in, his lower limbs. Lumbar X-rays showed the accurate positioning of the implant but lumbar magnetic resonance imaging (MRI) showed severe intervertebral disc herniation at L2/3 which was consistent with the findings of a physical examination and his symptoms (**Figure 3**). At this time, the patient underwent his second surgery: the nucleus pulposus of L2/3 was removed and the Isobar TTL was applied at L2/3 in an attempt to reduce intervertebral disc stress at L3/4 as L4-S1 had been fused in previous surgery (**Figure 4**). One week after surgery, the symptoms of weakness in, and numbness of, his lower limbs was relived; however, six months after his second surgery the patient strained his back and, once again, suffered serious weakness of, and numbness in, his lower limbs. Lumbar X-rays showed the dislocation of L2/3 and screw pull-out of the Isobar TTL implant (**Figure 5**).

After pre-operative discussion in our department, the patient received a revised surgery:

Figure 2. Twelve months post-operative (his first surgery) anterior-posterior, lateral, flexion, and extension X-rays, and computed tomography (CT) three-dimensional reconstruction images.

the Isobar TTL was removed, the spinous process and lamina of L3 were resected, the intervertebral disc at L2/3 was removed, porous nano-hydroxyapatite/polyamide 66 (n-HA/PA66) composite was inserted at L2/3, cement-reinforced pedicle screws were used, the screws and rods were collected, and the reduction was accomplished. When the cortical bone of the remaining lamina from L2 to L5 was removed, autogenous bone, combined with artificial bone, was implanted on the surface of the lamina. Hemostasis was rechecked and a drainage tube was inserted before the skin was sutured subcutaneously. Finally, the revised surgery was completed and the post-operative immediate X-rays showed the accurate positioning of the implants and satisfactory lumbar curvature (**Figure 6**). Three months post-operative (his third surgery) anterior-posterior, lateral X-rays, and the three dimensional reconstruction of CT scan images showed the continued accurate position of the implants and evinced bony fusion (**Figure 7**).

Discussion

The Isobar TTL has been widely used in patients as an alternative treatment method for the following diseases: spondylolisthesis and/or spondylolysis (with or without isthmiclysis), severe discoligamentary instability, major disc weakening, lumbar canal stenosis, degenerative scoliosis, and failed previous fusion. However, the Isobar TTL is not suitable for the following conditions: pathologic fractures of the vertebrae, severe osteoporosis of the spine, presence of active infection, or spinal metastases [5]. Li *et al*. report on the application of the

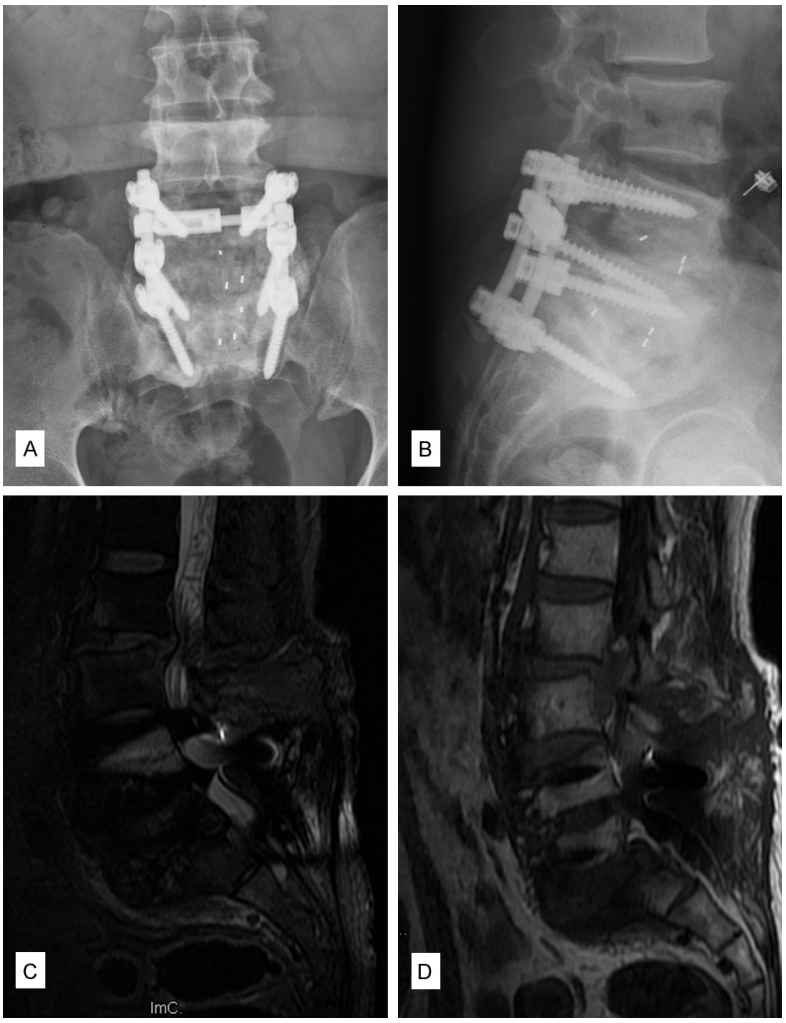

Figure 3. 15 months post-operative (his first surgery) anterior-posterior, lateral X-rays and lumbar magnetic resonance imaging (MRI).

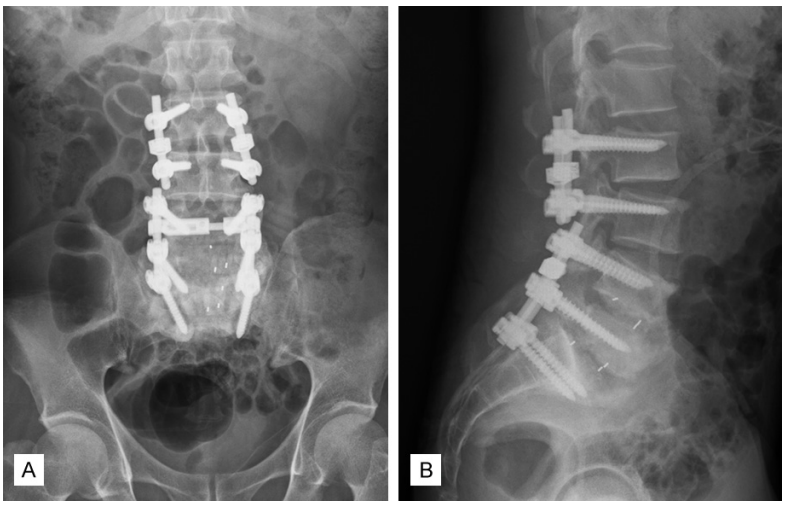

Figure 4. One week post-operative (his second surgery) anterior-posterior, lateral X-rays after the application of an Isobar TTL Semi-Rigid Rod System at L2/3.

Isobar TTL system in 37 patients (stenosis in 17, disc herniation with instability in 14, and degenerative spondylolisthesis in six) and they concluded that the Isobar TTL, after microsurgical decompression for lumbar degenerative disease, is safe and effective [5]. Barrey *et al*. report their biomechanical and clinical experiences of dynamic fusion with the Isobar TTL system and concluded that fusion with the Isobar TTL for degenerative lumbar spine diseases provided significant, stable, symptom relief [3].

In this case the patient suffered from serious weakness in, and numbness of, his lower limbs some 15 months after his first lumbar surgery and was diagnosed as suffering from severe intervertebral disc herniation at L2/3. Dynamic fixation with an Isobar TTL after resection of the nucleus pulposus of L2/3 was performed. No contraindications to the use of an Isobar TTL, such as severe osteoporosis of the spine, presence of active infection, or spinal metastases were found. The surgery was successful: the nucleus pulposus was resected through small lamina fenestration without violating the facet joints, the screws were inserted successfully in a single procedure; however, six months after his second surgery the patient strained his back and the lumbar X-rays showed the dislocation of L2/3 and screw pull-out in the Isobar TTL. All of the spinal surgeons in our department took part in a discussion in

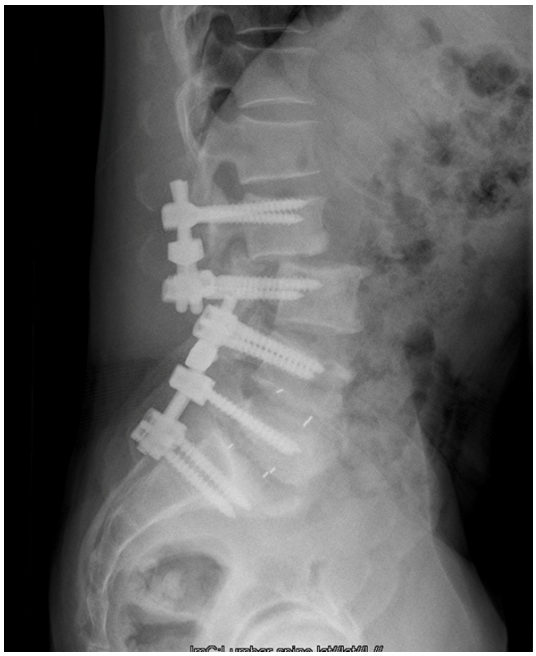

Figure 5. Six months post-operative (his second surgery) lumbar X-rays showed the dislocation of L2/3 and screw pull-out of the Isobar TTL.

an attempt to analyse the causes and to achieve a suitable revised surgery strategy.

Dislocation and screw pull-outs after small force trauma can often be attributed to pathological fracture caused by spinal tumour or severe osteoporosis [6]. However, this patient was free from spinal tumour and osteoporosis. Nucleus pulposus resection through small lamina fenestration without violating the facet joints has been used for several decades as an effective, and safe, treatment method which has little effect on lumbar stability [7]. In addition, the screws were inserted successfully without any adjustment. After exclusion of some common causes, two possible explanations have drawn our attention: 1) The patient may have suffered a powerful trauma but he merely reported a strained back for unspecified personal reasons. This is hypothetical and we have no evidence to that effect; 2) After resection of the nucleus pulposus, the disc height of L2/L3 decreased and more stress was born by the screws and pedicles of L2 as the angle between the screw and rod was too large. Repeated stress concentration on the screws and pedicles of L2 caused the fracture of the pedicles, loosening the screws, leading to screw pull-out and dislocation of L2/3. Even though the screw loosening, pull-out, and the fracture of the pedicles were confirmed in the third lumbar surgery, we consider this analysis as also hypothetical.

The application of the Isobar TTL at L2/3 has not been reported in previous studies, the biomechanical characteristics may be different from those prevailing at L4/5 or L5/S1. The real causes remain unclear at present. We also made several suppositions concerning the surgical method for the treatment of intervertebral disc herniation at L2/3 in this special case: 1) whether nucleus pulposus resection through small lamina fenestration without using of Isobar TTL is more suitable and may avoid the complication in the first place? 2) Whether nucleus pulposus resection through small lamina fenestration at L2/3, and the application of the Isobar TTL at L3/4, is more suitable in this case?

The last discussion point arising from this case report revolves around the revision surgical strategies adopted. Most spinal surgeons agree that removal of the Isobar TTL, resection of the spinous process and lamina of L3, intervertebral discectomy and interbody fusion at L2/3, and the application of cement-reinforced pedicle screws were suitable. Whether the patient should receive interbody fusion at L3/4 remains the focus of the debate. If the patient did not receive L3/4 fusion, fusion at L2/3 and fusion from L4 to S1 may lead to stress concentration and accelerated disc degeneration at L3/4. In the end, the patient received a revised surgery involving fusion from L2 to S1.

In summary, selection of appropriate patients is important for the application of the Isobar TTL system. The lamina should not be resected too much, the facet joints should not be violated, and pedicle screw adjustment should also be avoided in the application of the Isobar TTL. The angle between the screw and rod should be such that it avoids strength concentration on pedicles and screws which may lead to instrumental complications. The real causes remain unclear at present and future biomechanical and clinical studies are thus recommended.

Disclosure of conflict of interest

None.

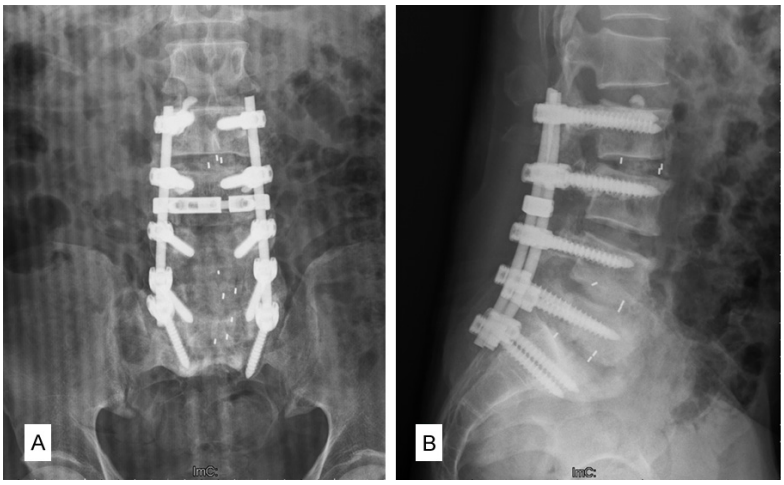

Figure 6. Post-operative immediate (his third surgery) X-rays showed the accurate positioning of the implants and satisfactory lumbar curvature.

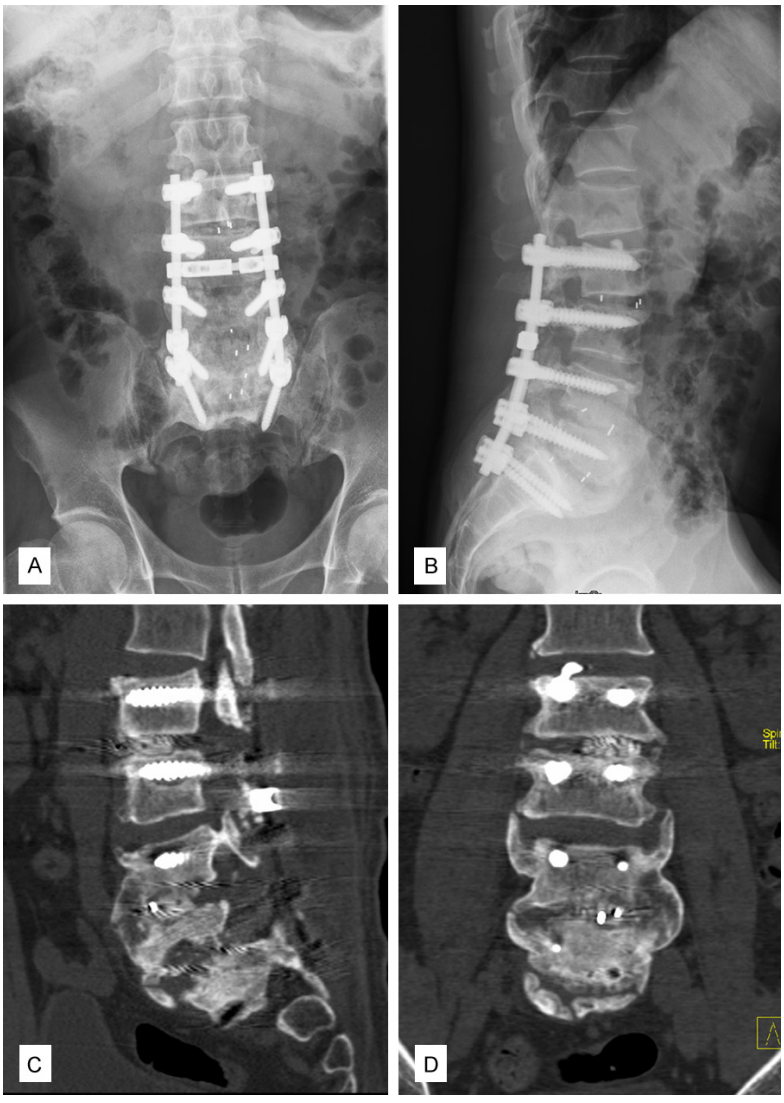

Figure 7. Three months post-operative (his third surgery) anterior-posterior, lateral X-rays (A, B), and the three-dimensional reconstruction of CT scan images (C, D).

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