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Paper #14

Accuracy of Screw Placement in Minimally Invasive, Robot-Assisted Iliosacral Screw Insertion in Children With Early Onset Neuromuscular Scoliosis

Francois Deroussen, Michel Lefranc, Céline Klein, Richard Gouron

Summary: Ilio-sacral screws used in pelvic fixation for neuromuscular scoliosis (early onset or extremely frail patients) are difficult to position. We reviewed 10 patients (20 implants) operated on with iliosacral screw insertion using robotic assistance. The trajectory planned was compared with the iliosacral screws; actual real position using pre- and post-surgery flat-panel CT images. All the screws were perfectly located within the sacrum. Robot-assisted implantation was associated with a high level of agreement between the planned and achieved screw positions.

Hypothesis: Robotic assistance enables the highly accurate implantation of iliosacral screws in case of pelvic fixation in neuromuscular scoliosis (early onset or extremely frail patients).

Introduction: Bipolar fusionless surgery is increasingly indicated for neuromuscular scoliosis (early onset or extremely frail patients). Ilio-sacral screws used in pelvic fixation in these cases have excellent biomechanical characteristics but are particularly difficult to position even with a dedicated instrument set. An incorrect trajectory can result in failure of the fixation or damage to the nerve root. Objective: To evaluate the accuracy of iliosacral implant positioning with robotic assistance.

Methods: A retrospective study of all patients operated on since October 2017 in our department for bipolar spinal instrumentation in neuromuscular scoliosis (early onset or extremely frail patients) using robotic assistance. The trajectory planned with the robot's software was compared with the iliosacral screws' actual real position. The pre- and post-surgery flat-panel CT images were merged. The distance was measured at two points on the trajectory (the iliac entry point, and the screw tip target point in the sacrum).

Results: Ten patients (20 implants) were included. The mean (range) age was 10.9 years (7.2–18.2). The mean ± standard deviation (range) error for 20 iliosacral screws was 1.93 ±0.7 mm (1.3–3.12) at the entry point and 1.49 ±0.41 mm (1–2.4) at the target point. All the screws were located within the sacrum (i.e. in the absence of cortical breaches). No neurological or vascular complications were associated with the positioning of iliosacral implants.

Conclusion: Robotic assistance enables the highly accurate implantation of Iliosacral screws, which guarantees biomechanical efficiency and limits morbidity related to the implant & position; even in young children.

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Paper #15

Introduction to a New Motorized Growing Rod: Animal Study and Preliminary Clinical Results

Franck Accadbled, Jérôme Sales de Gauzy, Martina Muller

Summary: An animal study was conducted. Expected length gain was reached in all cases. A clinical trial followed, involving patients aged 4 to 10 years with severe EOS. Non-invasive growth compensation was performed every 3 months. 2 patients have been included at the time of abstract submission. Planned lengthening was confirmed via feedback of the Control Set and sonography.

Hypothesis: An innovative motor-driven implant will provide curve correction and non-invasive growth compensation for the treatment of early onset scoliosis (EOS). The advantages are better reliability and accuracy in lengthening control and higher distraction force than current available implants.

Introduction: Despite better understanding and advance in surgical techniques, progressive EOS remains a therapeutic challenge. The motorized FITBONE® intramedullary lengthening nail has been used for limb lengthening for more than 2 decades with satisfactory results. The same technology has been used to design a new spinal growing rod.

Methods: Animal study: 3 Göttingen pigs were used. A single motorized growing rod construct was implanted, cranially fixed with ribs hooks and caudally with pedicle screws. The receiver for lengthening was placed subcutaneously in the lumbar fossa. Non-invasive distraction procedure was performed periodically 3 times a week with 2mm increments.
Clinical trial: 5 patients aged 4 to 10 years with severe EOS will be included in a prospective monocentric study. Depending on the individual case, single or dual rod constructs will be tunneled via two incisions. Growth compensation will be performed every 3 months inductively, via an external Control Set.

Results: Animal study: All animals recovered and resumed walking and feeding within 24h. Expected length gain could be reached in all cases as verified by CT scan measurement. Histological investigations after a total implantation time of 10 weeks did not show adverse reaction of surrounding tissues. Technical analysis by the manufacturer proved full system functionality without any superficial or hidden damages.
Clinical trial: 2 patients have been included at the time of abstract submission. Postoperative course was uneventful and 2 non-invasive distraction procedures were carried out. Predefined lengthening amount could be controlled via feedback of the Control Set and verified by sonography.

Conclusion: This new motor-driven implant has provided satisfactory preliminary results regarding safety, and functional reliability. Further investigations are obviously needed to confirm promising early results.

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Paper #16

Are Serum Ion Levels Elevated in Pediatric Patients with Growing Spine Implants vs. Controls?

Smitha Mathew, A Noelle Larson, Bangke Zhang, Yong Xie, Matthew Abdel, Andre J. van Wijnen, Todd Milbrandt, Geoffrey Haft

Summary: Serum titanium, cobalt, and chromiumlevels are elevated in pediatric patients with growing spine instrumentation compared to controls with extremity implants.

Hypothesis: Serum titanium levels would be elevated in pediatric patients with spinal implants, particularly growing spine devices compared to patients with extremity implants.

Introduction: Titanium (Ti) is thought to be among the most biocompatible metals. However, elevated serum Ti levels are seen in children with spinal implants. Using state-of-the-art assay tools, we assessed serum ion levels in 3