

Percutaneous iliosacral screw fixation for posterior pelvic ring injuries: the first experience, complications

Perkutaninė kryžkaulio klubakaulio sąnario fiksacija esant užpakalinio dubens žiedo sužalojimams: pirmoji patirtis, komplikacijos

Valentinas Uvarovas¹, Andrius Vaitiekus², Igoris Šatkauskas¹, Donatas Ulevičius²

¹ *Vilnius University, Medical Faculty, Clinic of Rheumatology, Traumatology Orthopaedic and Reconstructive Surgery, Vilnius, Lithuania*

² *Department of Orthopaedic Surgery, Republican Vilnius University Hospital, Siltnamiu Str. 29, LT-04130, Vilnius, Lithuania*

E-mail: andrius.vaitiekus@gmail.com

Background

Percutaneous iliosacral screw fixation is a minimally invasive technique for the treatment of unstable pelvic injuries involving the posterior ring. Nevertheless, screw malposition may result in dangerous complications involving injury to adjacent neurological structures. This study was conducted in order to evaluate the first results of using the percutaneous iliosacral screw technique at the Republican Vilnius University Hospital.

Objective

To report the early results and possible complications of percutaneous iliosacral screw fixation in the management of unstable pelvic ring injuries.

Methods

The data for the period 2011–2013 were collected retrospectively. Fifty-five patients who suffered from injury to the pelvic ring requiring surgical treatment were included in this study. Twenty-two operations were done using canulated screws (group A, 20 operations using 7.3 mm and 2 operations 8.3 mm screws), and 33 (group B) operations were done using non-canulated 6.5 mm screws. We compared our first results of using canulated and non-canulated screws. The data were analysed using MS Excel.

Results

From the analysed 55 patients, 20 (36.4%) were men and 35 (63.6%) women; the average age of the patients was 51 (range, 21–98) years. According to the AO (*Arbeitsgemeinschaft für Osteosynthesefragen*) classification, there were 49 patients with type B and 6 patients with type C. The mean operation time was 36 min (range, 10–115). Three patients from group B required reoperation because of a neurological injury. Two of these patients suffered from L5 neuropathy and one from S1 radiculalgia. The complication rate was 9.1 per cent in group B, and they were now complications in group B. Twelve patients underwent percutaneous iliosacral screw fixation and anterior fixation, one patient underwent percutaneous iliosacral conversion to

open posterior SI fixation osteosynthesis because of neurological complications, while the other 43 patients underwent percutaneous screw fixation only.

Conclusions

Percutaneous iliosacral screw fixation is a rapid, safe and definitive treatment for unstable pelvic ring injury. The technique using standard C-arm fluoroscopy may allow accurate location of the screw placed in S1 and result in fewer complications when using percutaneous cannulated screws.

Key words: percutaneous iliosacral fixation, cannulated iliosacral screws, three-dimensional fluoroscopy

Įvadas / tikslas

Perkutaninė kryžkaulio klubakaulio sąnario fiksacija sraigtais yra minimaliai invazinis operacinio gydymo metodas nestabiliems užpakalinio dubens žiedo sužalojimams gydyti. Vis dėlto gretimos nervinės struktūros gali būti pažeistos dėl blogos sraigto padėties. Mūsų darbo tikslas – įvertinti Respublikinės Vilniaus universitetinės ligoninės pirmuosius kryžkaulio klubakaulio sąnario operacinio gydymo perkutaninės fiksacijos būdu rezultatus ir nustatyti nestabilių dubens žiedo sužalojimų gydymo komplikacijų dažnį.

Metodai

Retrospektyviai išanalizuoti 2011–2013 metais gydytų 55 pacientų duomenys. Atliktos 22 operacijos naudojant kaniuliuotus (A grupė, 20 operacijų naudojant 7,3 mm ir 2 operacijos 8,3 mm sraigtais) ir 33 (B grupė) – nekaniuliuotus 6,5 mm sraigtais. Palyginome pirmuosius operacinio gydymo kaniuliuotais ir nekaniuliuotais sraigtais rezultatus. Duomenys analizavome MS Excel programa.

Rezultatai

Operuoti 55 pacientai, iš jų 20 (36,4 %) vyrų ir 35 (63,6 %) moterys. Tiriamųjų amžiaus vidurkis – 51 (21–98) metai. Pagal AO (*Arbeitsgemeinschaft für Osteosynthesefragen*) klasifikaciją buvo 49 pacientai. Trys B grupės (9,1 %) pacientai buvo peroperuoti dėl neurologinių komplikacijų (du pacientai dėl L5 neuropatijos ir vienas dėl S1 radikialgijos). A grupės pacientams komplikacijų nebuvo. Dvylikai pacientų atlikta perkutaninė kryžkaulio klubakaulio sąnario fiksacija ir kartu priekinė fiksacija ir 43 pacientams – tik užpakalinė kryžkaulio klubakaulio sąnario fiksacija sraigtais.

Išvados

Perkutaninė kryžkaulio klubakaulio sąnario fiksacija yra greitas, saugus ir galutinis nestabilių užpakalinio dubens žiedo sužalojimų operacinio gydymo metodas. Naudojant standartinį rentgeno C-lanką galima tiksliai lokalizuoti sraigto padėtį S1 slankstelio lygyje. Naudojant kaniuliuotus sraigtais komplikacijų nepasitaikė, o naudojant nekaniuliuotus sraigtais galimos neurologinės komplikacijos.

Reikšminiai žodžiai: perkutaninė kryžkaulio klubakaulio sąnario fiksacija, kaniuliuoti kryžkaulio klubakaulio sraigčiai, trijų dimensijų fluoroskopija.

Introduction

Percutaneous iliosacral screw fixation of unstable sacrum fractures has gained popularity since its introduction in the 1990s [1]. Percutaneous iliosacral screw fixation is a minimally invasive technique for the treatment of unstable pelvic injuries involving the posterior ring. Burgess et al. classified pelvic ring disruptions into three main groups: antero-posterior compression (APC), lateral compression (LC), and vertical shear (VS) fractures, based on the mechanism of injury. Unstable LC (*Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association*, AO/OTA 61-B) and VS (AO 61-C) fracture types are associated with increased morbidity

and mortality rates. Pelvic ring injuries are variable, difficult to treat and often associated with substantial morbidity and mortality [2]. Nevertheless, screw malposition may result in dangerous complications involving injury to adjacent neurovascular structures [3].

The first percutaneous iliosacral screw fixation was done at the Republican Vilnius University Hospital on November 15, 2011. We started using non-cannulated 6.5 mm iliosacral screws (our records). The present study was conducted in order to evaluate the first results of using the percutaneous iliosacral screw technique in the management of unstable pelvic ring injuries at the Republican Vilnius University Hospital.

Statistical analysis

The data were analysed using MS Excel.

Methods

We perform the percutaneous iliosacral screw fixation procedure using three-dimensional fluoroscopy. It is very important to do a correct pelvis inlet and outlet X-ray projections.

This procedure is done when the patient is lying on his back on the X-ray-permeable operating table. It is important to regulate the X-ray machine position, depending on the duration of the operation. The K-wire is inserted to control X-ray proximal to the S1 level. We perform a dorsolateral 1–2 cm skin incision. Once the guide pin is inserted, its safety is confirmed doing inlet and outlet radiographs (Figs. 1 and 2). Adjacently we insert another K-wire (Fig. 3). The K-wire must pass the SI joint, the wires tip should be at the the center of the sacrum body at inlet projection and in a half-way proximal S1 nerve root at outlet projection (Fig. 2). We started doing this procedure using non-canulated screws 6.5 mm in diameter, but now we use canulated screws with spacers 7.3 or 8.3 mm in diameter (Figs. 4 and 5).

Our data for the period from November 2011 till December 2013 were collected retrospectively. Fifty-five patients who suffered from an injury to the pelvic ring requiring surgical treatment were included in this study. Twenty-two operations were done using canulated screws (group A, 20 operations using 7.3 mm and 2 operations 8.3 mm screws), and 33 (group B) operations were done using non-canulated 6.5 mm screws. We compared our first results of using canulated and non-canulated screws.

To evaluate the screw position, including any invasion into the sacral foramen or canal because of neurological injury clinically examined during the early postoperative period, we performed postoperative pelvic computed tomography (CT).

Results

From the analysed 55 patients, 20 (36.4%) were men and 35 (63.6%) women; the average age of the patients was



Fig. 1. K-wire position, *inlet* projection

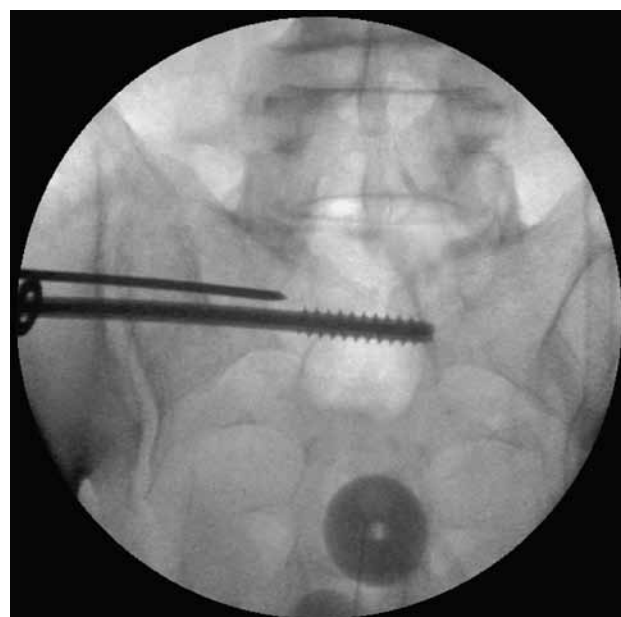


Fig. 3. Second K-wire insertion, *outlet* projection

51 years (range, 21–98). According to the AO (*Arbeitsgemeinschaft für Osteosynthesefragen*) classification, there were 49 patients with type B and 6 patients with type C. The mean operation time was 36 min (range, 10–115).



Fig. 2. K-wire position, *outlet* projection. Arrows show S1 foramen

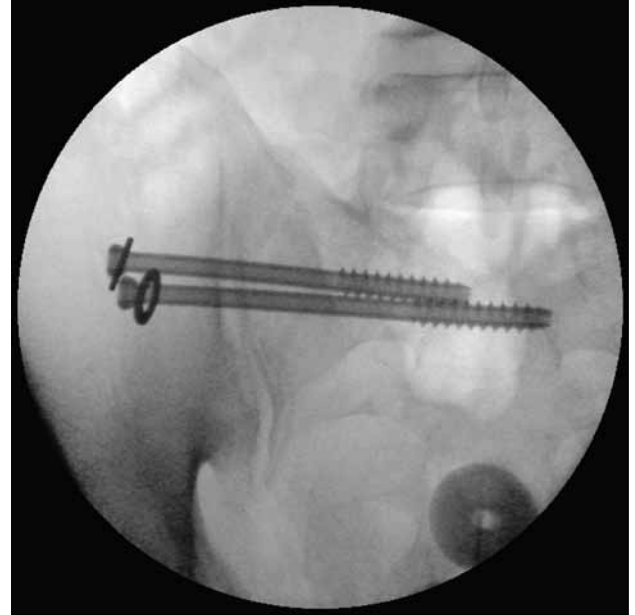


Fig. 5. Screw positioning, *outlet* projection

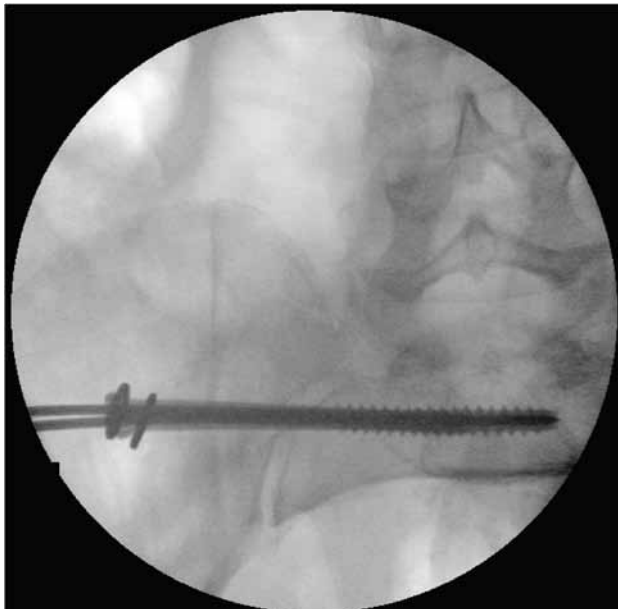


Fig. 4. Screw positioning, *inlet* projection

Three patients from group B required reoperation because of a neurological injury. Two of these patients suffered from L5 neuropathy and one from S1 radiculalgia. The rate of complications in group A was 9.1 per

cent, and there were no complications in group B. Twelve patients underwent percutaneous iliosacral screw fixation and additional anterior fixation, one patient underwent percutaneous iliosacral conversion to open posterior SI fixation because of neurological complications, while the other 43 patients underwent percutaneous screw fixation only.

Discussion

Percutaneous iliosacral screw placement allows a minimally invasive fixation of posterior pelvic ring instabilities [4, 5]. The percutaneous iliosacral screw fixation procedure is performed using three-dimensional fluoroscopy. It is very important to do a correct pelvis inlet and outlet X-ray projections [4, 6, 7].

We should see the sacral foramen and the sacral canal in inlet and outlet projections. We started this procedure using non-cannulated screws 6.5 mm in diameter, but now we use cannulated screws with spacers 7.3 or 8.3 mm in diameter. Nowadays, this procedure is done only with cannulated screws.

Nevertheless, screw malposition may result in dangerous complications involving injury to adjacent neurological structures [3]. Our first experience shows

that we had now neurological complications when using cannulated screws. In the literature, the rate of neurological complications is low [6, 7, 8].

Although percutaneous fixation with iliosacral screws has proved to be a safe and reproducible method for sacroiliac dislocation and sacral fractures, it is a technically demanding technique, and one of its contraindications is sacral anatomical variations and dysmorphism [9].

Sometimes there is a dysmorphic first sacral vertebra. In this case, the introduction of the screw becomes unsafe and unpredictable because of the smaller space between the anterior and posterior gaps and damages to one of the nerve roots. In this situation, the screw is needed to input through the second sacral vertebral body [10].

REFERENCES

1. Beck M, Kröber M, Mittlmeier T. Intraoperative three-dimensional fluoroscopy assessment of iliosacral screws and lumbopelvic implants stabilizing fractures of the os sacrum. *Arch Orthop Trauma Surg* 2010 Nov; 130(11): 1363–9.
2. Manson T, O'Toole RV, Whitney A, et al. Young–Burgess classification of pelvic fractures: does it predict mortality, transfusion requirements, and non-orthopaedic injuries? *Orthop Trauma* 2010; 24: 603–9.
3. Routt ML Jr, Kregor PJ, Simonian PT, Mayo KA. Early results of percutaneous iliosacral screws placed with the patient in the supine position. *J Orthop Trauma* 1995 Jun; 9(3): 207–14.
4. Osterhoff G, Ossendorf C, Wanner GA, Simmen HP, Werner CM. Percutaneous iliosacral screw fixation in S1 and S2 for posterior pelvic ring injuries: technique and perioperative complications. *Arch Orthop Trauma Surg* 2011 Jun; 131(6): 809–13.
5. Jones CB. Posterior pelvic ring injuries: when to perform open reduction and internal fixation. *Instr Course Lect* 2012; 61: 27–38.
6. Kim JW, Oh CW, Oh JK, Lee HJ, Min WK, Kyung HS, Yoon SH, Mun JU. Percutaneous iliosacral screwing in pelvic ring injury using three-dimensional fluoroscopy. *J Orthop Sci* 2013 Jan; 18(1): 87–92.
7. Routt ML Jr, Simonian PT, Mills WJ. Iliosacral screw fixation: early complications of the percutaneous technique. *J Orthop Trauma*. 1997 Nov; 11(8): 584–9.
8. Rysavý M, Pavelka T, Khayarin M, Dzupa V. Iliosacral screw fixation of the unstable pelvic ring injuries. *Acta Chir Orthop Traumatol Cech* 2010 Jun; 77(3): 209–14.
9. Karachalios T, Zibis AH, Zintzaras E, Bargiotas K, Karantanas AH, Malizos KN. Anatomical update on the morphologic variations of S1 and S2. *Orthopedics* 2010 Oct 11; 33(10): 733.
10. Uvarovas V., Kocius M. Dubens žiedo sužalojimai. Metodinės rekomendacijos II. 62 p.)
11. Gänsslen A, Hüfner T, Krettek C. Percutaneous iliosacral screw fixation of unstable pelvic injuries by conventional fluoroscopy. *Oper Orthop Traumatol* 2006 Sep; 18(3): 225–44.
12. Gardner MJ, Routt ML Jr. Transiliac-transsacral screws for posterior pelvic stabilization. *J Orthop Trauma* 2011 Jun; 25(6): 378–84.