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Pregnancy-related pain in ilio-sacral joint and its low-burden surgical treatment

L.F. Ciupik, R. Gasik, A. Kierzkowska, P. Powchowicz, E. Słoński, M. Sędziak

key words: *pregnancy, pregnancy-related pelvic girdle pain, lumbosacral pain, sacroiliac joint fusion, ISaF*

Abstract
Hormonal changes occuring during period of pregnancy lead to increased ligamentous joint laxity and widening of the pelvic joints. Reallocation of the center of the mass with the progress of pregnancy affects in increased load of lumbar spine and pelvic joints. In some women, this leads to excessive laxity of the iliosacral joints (ISJ) and symphysis pubis joint (SPJ). The result is a pain which is often mistaken with also appearing low back pain (LBP). The aim of this study is to present the problem of the pregnancy impact on the musculoskeletal system and to discuss the ISaF procedure as one of solutions for surgical treatment of the iliosacral joint when conservative treatment fails.

Hormonal Changes

Presence of lumbopelvic pain have a negative impact on everyday life, and it is a common complaint during pregnancy and postpartum. Being an outcome of various factors that derive from hormonal changes caused by pregnancy. Distinct boost in levels of estrogen and relaxin causes increase in ligamentous joint laxity in pelvis.[1,2,3,4] Accompanied by growth of the body mass and presence of the gravid uterus cause a shift of the center of gravity, followed by increased lumbar lordosis and anterior pelvic tilt (Fig.1).[1] All of the above lead to additional loads being present on axial skeleton affecting in particular lumbar section of spine, ilio-sacral joint (ISJ) and symphysis pubis joint (SPJ), often causing pain.[1]

Types of pregnancy-related pains

Two main types of back pain related to pregnancy can be distinguished: low back pain - LBP and pelvic girdle pain – PGP.[1] Often LBP and PGP occur combined. LBP can be described as a pain in the lower lumbar region, above the sacrum, with possible pain radiation into the leg.[1,3] Prevalence of LBP in pregnant women ranges between 20% and 90%, where about 50% of women reported presence of pain 1 year

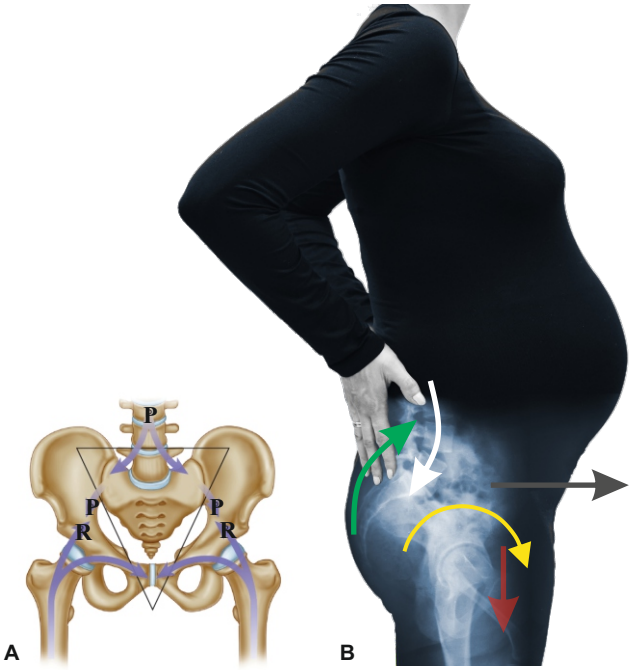

Fig.1. *Transmission of trunk forces (P) and ground forces (R) into the self-locking system of the sacroiliac[5] (A) Changes in the musculoskeletal system during pregnancy: shift of the center gravity (gray arrow), increased load (red arrow), anterior pelvic tilt (yellow arrow), increased lumbar lordosis (green arrow) (B)*

postpartum. Definition of PGP and LBP greatly overlap, often resulting in combined diagnosis.[3,6,7] Currently PGP can be described as pain located in ISJ, radiating from level of the posterior iliac crest to the gluteal fold, sometimes reaching the rear thigh.[1,3,6] PGP tend to merge with SPJ pain.[1,3,6,7] The prevalence of PGP ranges from 14 % to 25%[1,3] (when excluding LBP). PGP is associated with greater pain than LBP, resulting in greater mobility impairment, furthermore the treatment of PGP is considered to be more challenging.[1] PGP generally begins around 18th week of pregnancy reaching its


Lechosław F. Ciupik
LfC CEO, dr inż.


Robert Gasik, neurochirurg,
prof. dr hab. n. med


Agnieszka Kierzkowska
dyrektor ds. badań, dr inż.


Paweł Powchowicz
mgr bioinżynier


Edward Słoński
mgr bioinżynier


Maja Sędziak
mgr bioinżynier

peak around 24th and 36th week.[1,3,6] Literature points out that, PGP usually resolves within 6 months postpartum[1], although between 8% to 10% of women continue to report pain for 1 to 2 years postpartum. [1,3,8]

Challenging diagnosis of pelvic girdle pain (PGP)

Correct diagnosis of PGP in ISJ is crucial as "Untreated or poorly treated ISJ pains become chronic".[9] Series of ISJ provocation tests can be performed to confirm or deny ISJ dysfunction as a source of pain. There happen to be a large discrepancy in the results due to individual assessment of physician performing a test. Thus, it is crucial that a large quantity of tests are being conducted to verify the diagnosis of ISJ.[9] Differentiation process between PGP and LBP, without the presence of SPJ is very challenging.[1] According to Robert Gasik[9], around 54% of pregnant women with diagnosed LBP and PGP suffer from pains having its origin in ISJ.

Instability of ilio-sacral joint (ISJ)

ISJ is a semi-tight joint with limited range of motion.[10] Excessive relaxation of the ligaments of the joint leads to instability manifested by "separation" of the pelvis bone from the sacrum, and hypermobility of the joint.[11,12] The loss of stability is associated with disturbance in a structure called "form closure" consisting of sacrum and ISJ.[12,13] The "self-locking" mechanism relies on wedging of the sacrum between the ISJ under a compressive load. The sacrum is thus referred to as the system's "arch key", and the ISJ act as a shock absorbing mechanism.[13] The pregnancy related instability of the ISJ can be aggravating and lead to partial mobility impairment in women.

Instability of symphysis pubic joint (SPJ)

Pubic symphysis is a non-synovial joint, described as fibro-cartilaginous disc, which is stabilized by four ligaments.[14] SPJ has a limited range of motion between 0.5 to 1 mm. Physiologically, natural extension of the symphysis pubis during the pregnancy, as a part of woman's preparation to labor, can be increased by 2 to 3 mm.[14] Usually, during the pregnancy or post labor, the gap extend up to 10 mm. [1,13]

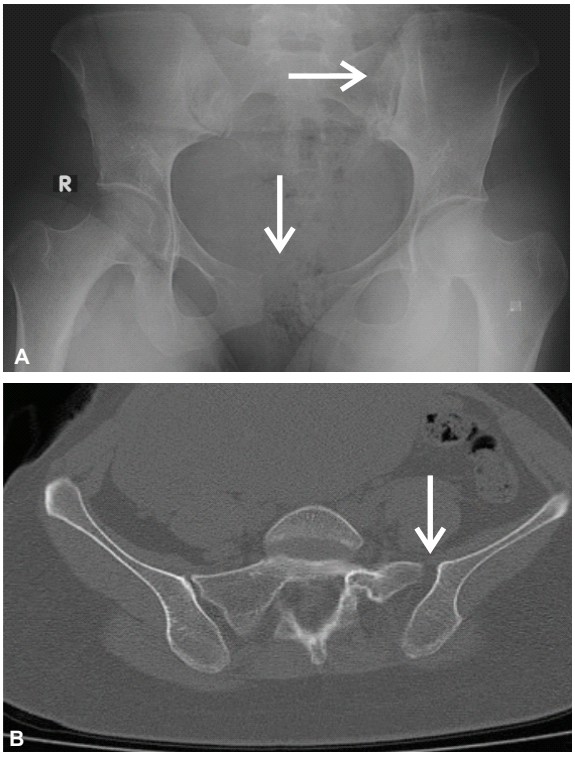

Fig.3. *Anteroposterior radiograph of the pelvis demonstrating gross disruption of the public symphysis, with a separation of 24 mm and disruption of the left sacroiliac joint (A); CT image demonstrating widening of the left anterior sacroiliac joint (B); Images come from the article*[8]

described is as pubic symphysis diastasis.[8,13,14,15] Diastasis is a proof of pubic instability, but its prevalence is very low,[6,7,13] often being a result of rapid vaginal birth (Fig.3). According to the literature, vertical displacement of the diastasis above the value of 20 to 25 mm seriously violates the ISJ. [1,13]

Noninvasive and surgical treatment of PGP

Common treatment of pregnancy related PGP is based on stabilization of pelvis with use of a brace-pelvic belt supported with muscle strengthening exercises. Conservative treatment also include nerve stimulation, use of analgesics and conventional treatments are not sufficient.[8] Treatment of diastasis incorporate open reduction of pubic symphysis, internal fixation with plates and screws on joint or external fixation of pelvis. If ISJ remain excessively widened and unstable ilio-sacral screws are used.[1,9] One of surgical procedures treating postpartum instability of ISJ is a stabilization procedure known as IlioSacral autogenic Fusion

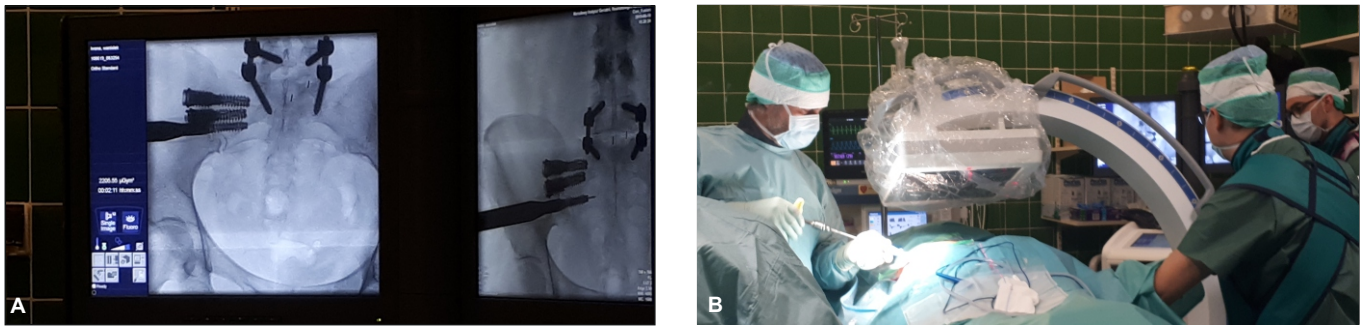

Fig.2. *The final stage of ilio-sacral stabilization (B) with the ISaF system (A) after double lumbar fixation*

List of used acronymns:
LBP- *low back pain;* **PGP**- *pelvic girdle pain;* **ISJ**- *ilio-sacral joint;* **SPJ**- *symphysis pubis joint;* **DSP**- *diastasis symphysis pubis;*

(ISaF) (Fig.2), provided by LfC company (patent[16] UE Dr. L. Ciupik). Procedure using meshed 3D-Truss-Ti screw-cage guarantee controlled compression and fixation of intra-articular space, which is crucial in treating of exceeded perinatal dilation, instability of ISJ. Novelty and a great advantage of this implant lay in transport and compaction of patient's autogenous bone towards the intra-articular space, accompanied by formation of the "bone collar" around the implant. Furthermore, the manufacturing process of the ISaF with the use of Electron Beam Technology (EBT) delivers meshed-structure with porous outer surface, supporting the process of bone fusion. Summing up, ISaF structure ensures the four key principles called **"4a"**:

- automated formation of **autogenous** "bone collar" inside the joint around the implant for quicker fusion;
- **autonomous,** independent to implant positioning, transport of the bone towards the I-S joint;
- **accelerated** bone growth due to unique design of the 3D-Truss-Ti structure;
- reconstruction of shape of the I-S space through **augmented** and controlled compression.

For treatment of single joint it is recommended to use 3 ISaF implants in accordance to non-linear positioning immobilizing the joint ("triad of support"). If the anatomical features of the patient preclude the use of 3 ISaF implants, it is possible to replace one of them with a smaller equivalent, a single-pieced 3D-Truss-Ti I-S implant. In unique, anatomically dysmorphic cases of sacrum bone, use of only 2 ISaF implants is considered, however this approach can provide lower level of stability.

Summary

Accompanying pregnancy, occurring various changes in the musculoskeletal system vary from woman to woman. Whereas, some are more predisposed to adapt to those changes, LBP and PGP will be a problem for some patients and should not be neglected. It is crucial for a health-care professional to understand the differences between the origin of PGP and LBP, and to be aware of the importance of correct diagnosis as some untreated conditions can have lasting and debilitating consequences. One of the new available tools offering innovative treatment options are DERO – ISaF implant systems used for surgical fixation of ilio-sacral joint instability with fusion, assisted by the patient's autogenous (own) bone tissue. ISaF method is a minimally invasive method ("short" 40-60 min surgery), considered to have a low strain on a patient during and post-surgery. ISaF ilio-sacral stabilization indicates to be highly efficient.

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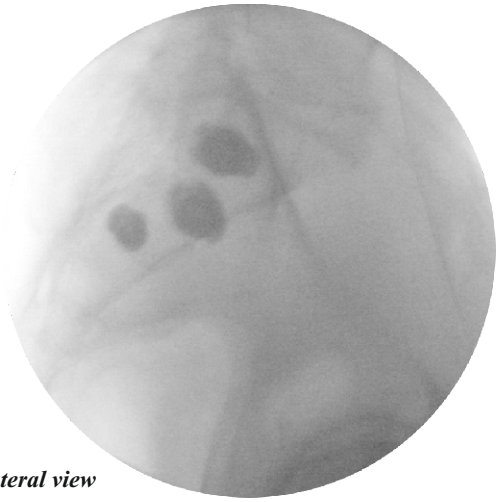
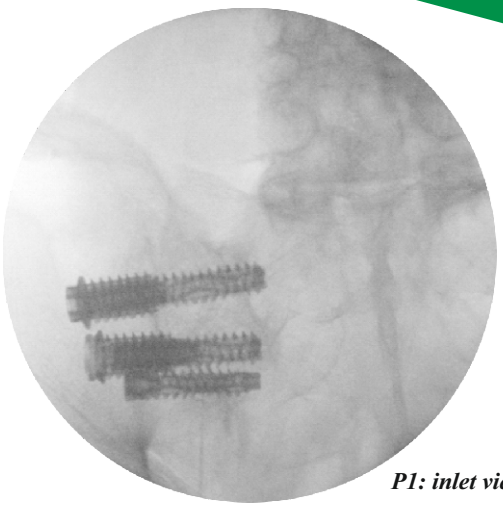
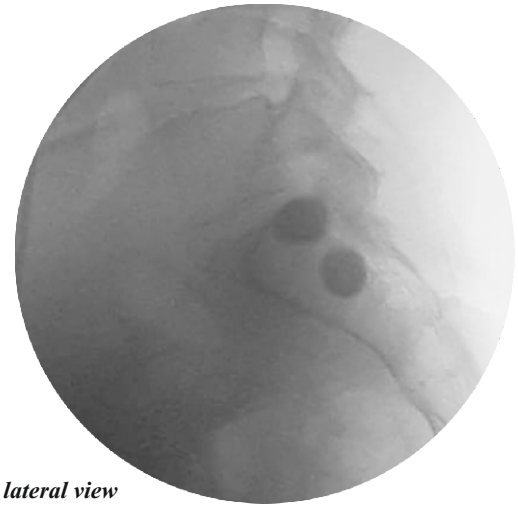
EXAMPLES OF CLINICAL CASES



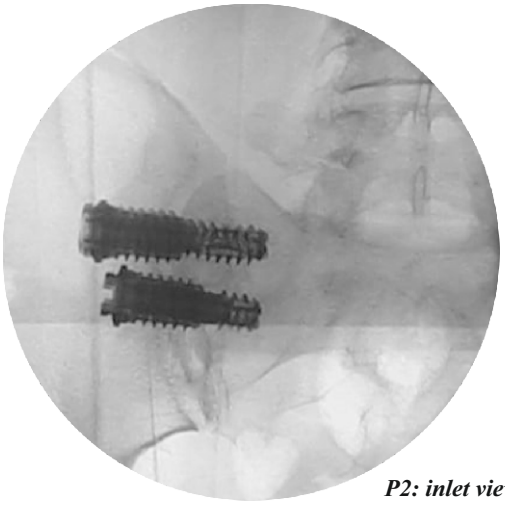
P1: lateral view



P1: inlet view



P2: lateral view



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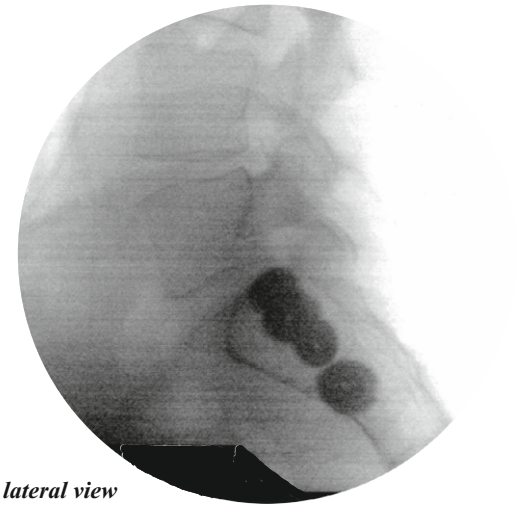
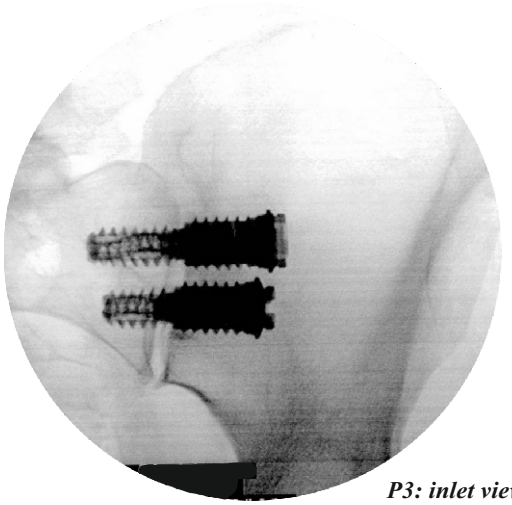


P3: lateral view



P3: inlet view