

Pelvic bone surgery and natural delivery: absolute and relative contraindications

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SUMMARY

Objective. The gynecologist often involves the orthopaedic surgeon in the evaluation of pregnant women with previous medical history of pelvic surgery who will give birth. Young women can receive pelvic surgery for proximal femoral fractures, sacro-iliac or pelvic ring fractures, avascular necrosis of the femoral head, hip dysplasia and severe ankylosing spondylitis. The aim of this study is to determine whether such women can accomplish a natural delivery or should have caesarean delivery (C-section).

Methods. Pubmed and the Cochrane Database of Reviews were searched for manuscripts including the years 1970 to present.

Results. It is important to discriminate between pathological and/or post-surgical conditions affecting the coxo-femoral joint which constitute an absolute contraindication to vaginal delivery from other circumstances that may have a relative contraindication. Orthopaedic relative indications for C-section may include coxo-femoral pathologies where coxo-femoral joint range of motion is limited and women cannot assume a given position that is deemed necessary by the obstetric specialist for natural delivery. Conditions requiring C-section are those producing an insufficient width of the bony birth canal; when the transverse mid-pelvis diameter is <9.5 cm, then the probability of C-section is increased.

Conclusions. It is not mandatory to perform a C-section in all women with a past medical history of pelvic surgery; accurate medical history collection, imaging technologies and ultrasound make it possible decide if a C-section is compulsory.

Key words: cesarean section, pelvic osteotomy, vaginal delivery, total hip replacement, pelvic fractures

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Conflict of interest

The Authors declare no conflict of interest

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Introduction

The gynaecologist frequently requires orthopaedic counselling for evaluation of pregnant women with past medical history of coxo-femoral or pelvic ring surgery to determine the feasibility of vaginal delivery.

These surgical procedures are performed to correct bony pelvis congenital or acquired pathologies, or to fix fractures in this anatomical district.

Whereas using simple logic we can infer femoral osteotomies do not influence pelvic girdle morphology, the effects of pelvic osteotomies on bony birth canal are still poorly studied, and literature is scarce.

Although the number of preterm childbirths, low birth weight and peri-partum complications does not differ between women who had undergone a peri-acetabular osteotomy (PAO) during childhood and controls, a recent article highlighted that cae-

sarean delivery is most frequently encountered among the first. The authors concluded the aforementioned discrepancy could be partially blamed on the obstetrician's unfounded fears to let these patients attempt vaginal delivery^{1,2}.

Agrawal states that in the obstetric community there is a belief women who had experienced pelvic fractures cannot deliver vaginally³.

During labour, women first assume an extended hip position called *counter-nutation* which widens the pelvic inlet, thus promoting the foetal descent into the bony birth canal; subsequently, a flexed hip position with consequent *nutation* of the pelvis, this time increasing the anterior-posterior outlet diameter, in order to favour the expulsion phase. The relative mobility of the pubic symphysis plays an important role during childbirth as well⁴.

Among pathological and/or post-surgical conditions affecting the coxo-femoral joint, we must distinguish between those that constitute an absolute indication for caesarean section (C-section) from others that might receive a relative indication; in this latter situation, the final choice depends on the patient's local and general health conditions, childbirth environment and skills and experience of the obstetrician.

This article reviews the current literature on delivery and pelvic bone pathologies, and clarifies the absolute and relative indications for a caesarean delivery in women who have undergone pelvic brim surgery due to developmental dysplasia of the hip (DDH), congenital dislocation of the hip, Perthes' disease, trauma with consequent fracture-dislocations or pathologies affecting the coxo-femoral joint such as osteonecrosis of the femoral head, transient osteoporosis of the hip (TOH), ankylosing spondylitis (AS) and coxa profunda.

Methods

Pubmed and the Cochrane Database of Reviews were searched for manuscripts including the years 1970 to present. Search terms used include: "osteotomy and vaginal delivery", "osteotomy and pelvic ring changes", "osteotomy and bony birth canal", "osteotomy and natural delivery", "hip arthroplasty and natural delivery", "osteonecrosis and natural delivery", "transient osteoporosis of pregnancy and natural delivery", "hip fusion and vaginal delivery", "ankylosing spondylitis and vaginal delivery", "coxa profunda", "rheumatoid arthritis and pregnancy", "birth canal and developmental hip dysplasia", "childbirth and hip arthrodesis". The following query strings didn't produce any result: "coxa profunda and vaginal delivery", "coxa protrusa and vaginal delivery", "birth canal and coxa profunda"; the query "birth canal and developmental hip dysplasia" returned some articles, none of our interest.

Results

Based on the research we carried out, we note that it is possible

to differentiate between relative and absolute contraindications for vaginal delivery.

Relative contraindications include coxo-femoral joint pathologies in which motility is affected and impairs the possibility to assume certain positions, deemed necessary by the obstetrician, to give natural birth.

All conditions which cause hip stiffness, even unilateral, constitute a potential limitation to assume the correct position (lying down, sitting or crouching) needed to achieve an effective abdominal push during labour.

Among the congenital or acquired coxo-femoral pathologies that can lead to ankylotic outcomes of the hip, congenital dislocation of the hip and more frequently osteonecrosis of the femoral head should be mentioned. The latter is consequent to vascular interruption in the proximal femoral epiphysis, with partial or total osteochondral necrosis; it can be idiopathic, and affect even the young adult, or it can be secondary, often caused by prolonged steroid intake more often for rheumatic or oncological pathologies, frequently bilateral and severe⁵.

Hip dysplasia itself is not associated with greater difficulty in performing natural birth delivery; even an open reduction of a congenital hip dislocation or a femoral osteotomy, by not changing the physiological shape and maintaining the size of the pelvis, do not represent an absolute indication to C-section⁶.

Given the high bone remodelling capacity in the developmental phase, pelvic girdle surgery performed before the sixth year of age allows restoration of physiological pelvic diameters and therefore to face a natural birth once fertile⁷.

Conversely, when pelvic surgery takes place after the sixth year of age, there may be an alteration in pelvis-size that can make a natural birth difficult.

In these cases, it may be useful to know what type of surgery had been performed⁸.

Ganz osteotomy (PAO) is a consolidated surgical technique advised to treat young patients with primary or secondary symptomatic acetabular dysplasia (Wiberg's angle < 20°) or in cases of pelvic retroversion with insufficiency of the posterior wall. It allows effective correction of the acetabular orientation on the three planes, while maintaining cartilage contact and joint congruence without changing the pelvic diameter (Fig. 1)⁹.

A pathological condition that determines progressive mechanical limitation of the coxo-femoral joint range of motion (ROM) is AS. This is a chronic inflammatory rheumatic disease mainly characterised by axial joint pain and stiffness¹⁰. The cause of AS is unknown, although variations in the human leukocyte antigen B-27 (HLA-B27) are recognised to be strongly associated with the development of the disorder¹¹. The management of an AS-complicated pregnancy has rarely been reported in literature. Theoretically, the restriction of hip joint mobility may be a mechanical hindrance that prevents the foetus from exiting the bony birth canal, increasing the risk of emergency C-section. The rate of C-section in pregnancies complicated by AS patients reported by Jakobsson et al and Zbinden et al. was as high as

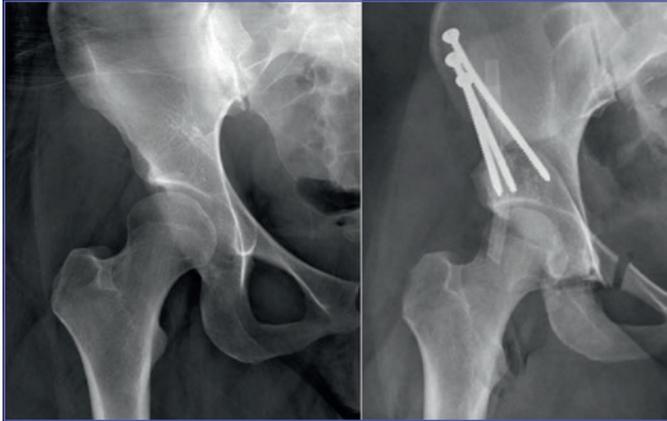


Figure 1. Right hip X-rays, preceding and following Ganz osteotomy.

The image on the left shows the pre-operative investigation, prescribed in order to plan the surgery. The image on the right is the post-operative X-rays; please note there is no pelvic diameter reduction.

28.9-39.7%^{12,13}. However, it appears tumour necrosis factor inhibitors, disease-modifying antirheumatic drugs (DMARDs), or corticosteroids, administered to treat pre-eclampsia or other severe pathologies, are the main cause of vaginal delivery failure in their studies, rather than hip stiffness itself. Similarly, the C-section rate was 13.3-44.8% in patients with rheumatoid arthritis, as observed in other studies where the use of a DMARD was the only factor associated with the need for C-section^{13,14}. Therefore, AS appears to have a minimal influence on the feasibility of vaginal delivery as far as hip joint disorders are concerned. In general, if the AS is well controlled and other obstetric complications such as breech presentation, nuchal cord or pre-eclampsia are absent, it is not essential to limit delivery options.

Another pathological condition which represents a relative contraindication to natural childbirth is transient osteoporosis of the hip (TOH). TOH consists in a self-limiting process of demineralisation of the femoral head and neck, with gradual spontaneous resolution over the course of 6-8 months¹⁵.

This characteristic distinguishes it from the more common and pathologic condition of menopause-associated osteoporosis. TOH is usually heralded by the acute onset of pain, intensified by weight bearing and relieved with rest, and disproportionate functional disability.

Since this pathology manifests itself mainly with pain that limits the coxo-femoral joint motion in absence of a true mechanical impairment, it does not represent an absolute contraindication to natural childbirth.

Additionally, coxa profunda can be listed among the relative contraindications to accomplish natural delivery; radiographically, it is the finding of an acetabular fossa medial to the ilio-ischial line. The more common prevalence of coxa profunda in

females may be an adaptation to the wider pelvis which accommodates obstetric demands¹⁶. From a biomechanical perspective, a deep acetabulum moves the hip joint centre medially. This change reduces the moment arm for the centre of mass, and therefore reduces hip abductor required force, a potentially energetic advantage¹⁷. Thus, a deep hip socket may be a beneficial variation instead of a pathologic variant.

Eventually, hip arthrodesis belongs to this group. Hip fusion (HF) has served well for over half a century as the surgical gold standard to treat painful joints with severe osteoarthritis or tuberculous arthritis. However, the introduction and development of total hip arthroplasty (THA) have now dramatically restricted its indications. Kirkos et al., in a study on 16 females who underwent HF, showed that although 5 female patients reported difficulty mainly in abducting their hips, two of them conceived and gave birth to two children each. They both had vaginal deliveries without complications¹⁸.

Conditions that constitute an absolute indication to C-section are those that imply an insufficient amplitude of the bony birth canal. According to Loder there is an increased risk of caesarean delivery in cases where the interspinous distance is less than 9.5 cm by anteroposterior (AP) pelvic x-ray (Fig. 2)⁸.

Other studies describe as determinant not the absolute measure of this parameter, but the difference between the smallest pelvic diameter and bi-parietal distance of the foetal head: thus, a cephalo-pelvic index is obtained. If the result is less than 9 mm, a vaginal route will be mechanically impossible; with an index between 9 and 13 mm a C-section will be probable; a natural route will be possible with an index > 13 mm¹⁹.

An example of pelvis osteotomy used to correct the defects of congenital hip dysplasia is that according to Chiari²⁰ (Fig. 3); it consists of a supra-acetabular transverse osteotomy, in which the cranial stump of the ileum is lateralised. As a consequence of the relative medialisation of the ischio-pubic-acetabulum

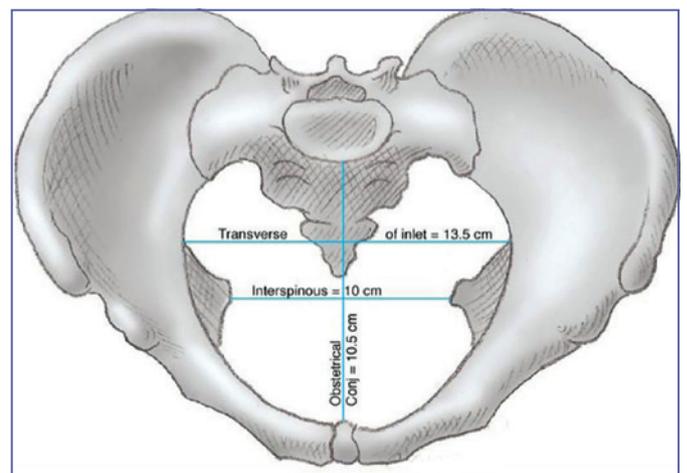


Figure 2. Shows the interspinous distance and the other pelvic diameters.

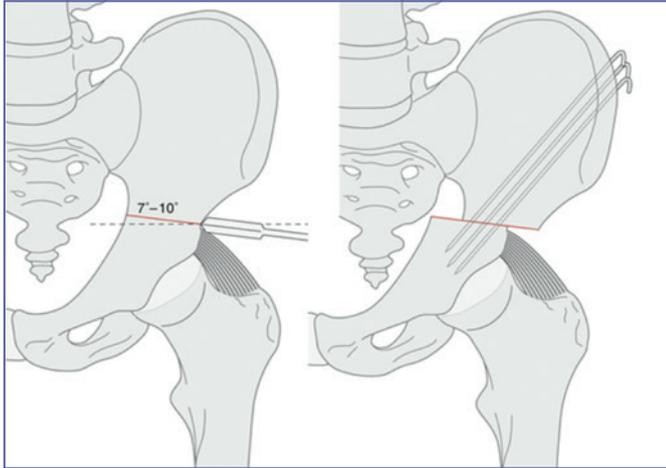


Figure 2. Schematic drawing of a pelvic girdle. On the left, pre-operative planning preceding a Chiari osteotomy. On the right, representation following a Chiari osteotomy; please note the iliac bone medialization and the reduction in pelvic diameter.

block, there is a significant reduction in the transverse diameter of the pelvis. This situation is even more evident in the non-rare cases of bilateral Chiari osteotomies²¹. Indications for this pelvic osteotomy in children are different, mainly related to the treatment of congenital hip dysplasia, with the aim to expand the acetabular cavity by increasing its congruence with the femoral epiphysis, and to treat Perthes disease, with the aim to modify the load that the joint undergoes.

The least common types of pelvic surgery that might cause concern are Steel, Sutherland and Salter osteotomies when performed bilaterally or after the sixth year of age¹⁹.

The outcomes of pelvis fractures and fractures-dislocations, especially those not treated correctly, can cause a narrowing of the birth canal at all levels²². In this case there is an absolute indication for C-section. Given the importance of pubic symphysis and sacroiliac joint mobility during labour, concern may be warranted if there is fixation across these joints³.

Particular attention must be paid to the presence of hardware that hinders the ROM of the sacroiliac joint, or that blocks the pubic symphysis: these conditions can, in fact, constitute a relative indication to C-section. However, thanks to the recent setup of dedicated surgical approaches and shared strategies of osteosynthesis, the treatment of these traumatic injuries tends towards anatomical reconstruction, thus making a vaginal delivery possible.

A small number of female patients in reproductive age have undergone THA, and may be concerned about being pregnant and delivering naturally. They recall a past medical history of inflammatory arthritis, femoral head osteonecrosis, or congenital hip dysplasia that required a hip replacement; these women can be reassured they can experience a normal pregnancy and vaginal delivery without any increased risk of complications.

C-section should be performed for obstetrical indications^{23,24}. The main issue to accomplish a vaginal delivery with a hip prosthesis is maintaining hip flexion below 90° and limiting internal and external rotations, so that the joint is kept as close as possible to a neutral position. Monaghan et al. reported a case of bilateral total hip replacement with subsequent successful vaginal delivery of a baby weighing 3780 g; bilateral abduction restriction inferior to 30° was maintained, indicating that the restriction of hip movement has no obvious influence on vaginal delivery²⁵. Pregnancy will not decrease the longevity of the device, and there is no need for early revision. However, one study showed that during pregnancy patients with THA are more apt to complain of hip pain, which sometimes persists after giving birth; if pain cannot be controlled, it can lead to THA revision²⁶. Ultimately, THA is not a reason to refrain from pregnancy and patients should be reassured.

Discussion

Lack of references about this topic in the scientific literature prompted us to examine the pathological conditions affecting the hip and pelvic ring that can influence natural birth delivery, with the goal to shed light on best practices.

Indication for C-section is undoubtedly multifactorial, but an objective univocal index should be provided: this can be the measurement of the pelvic diameters, and possibly their comparison with the foetal bi-parietal diameter measured by ultrasound.

In everyday practice, however, it is the experience of the gynaecologist that allows comprehensive evaluation of the anamnestic and clinical data, and permits to opt for C-section or natural delivery, with the possible support of the orthopaedic consultant.

Caesarean delivery can be performed safely, allowing a decrease in maternal or foetal mortality in cases of maternal or foetal complications. However, the procedure has the disadvantage of increasing the risk of asthma in the newborn and can cause future subfertility and pregnancy-related complications in the mother²⁷.

Hip implants do not affect the completion of a vaginal birth, nor does a natural birth decrease the survival of a hip prosthesis.

Conclusions

In conclusion, relative orthopaedic indications for C-section may include coxo-femoral pathologies where motility is limited and the possibility to assume a position deemed necessary by the obstetric specialist for natural delivery is impaired. Conditions requiring C-section are those producing an insufficient width of the bony birth canal (Tab. I).

Once skeletal maturity is reached, the transverse diameter at the mid-pelvis level is < 9.5 cm, then the probability of Caesarean section increases; it is good practice to inform pregnant woman at first visit.

Table I. Relative and absolute contraindications to vaginal delivery.

Relative contraindications	Absolute contraindications
<ul style="list-style-type: none"> ▪ Femoral head osteonecrosis ▪ THA ▪ Coxo-femoral joint arthrodesis ▪ Coxa profunda (protrusa) ▪ Ganz osteotomy (PAO) ▪ AS ▪ Transient osteoporosis of the hip ▪ DDH ▪ Congenital hip dislocation ▪ Presence of hardware devices for the treatment of pelvic fractures 	<ul style="list-style-type: none"> ▪ Chiari osteotomy ▪ Steel, Sutherland and Salter osteotomy (if performed bilaterally or after 6 years of age) ▪ Non anatomically reduced pelvic fracture ▪ All those conditions that cause a reduction in birth-canal width

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