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Case report

Bifocal Stress Fracture of Pubic Rami after Contralateral Total Hip Arthroplasty and Longstanding Ipsilateral Hip Fusion

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A B S T R A C T

In this case report we present a patient with bifocal pubic rami stress fractures after contralateral total hip arthroplasty for congenital hip dysplasia and longstanding ipsilateral hip fusion. Treatment protocol for patients with various degrees of hip arthritis on one side and contralateral longstanding hip fusion are proposed based on the literature and our and previously published cases.

Key words: *stress fracture, pubic ramus, hip arthrodesis, hip dysplasia, total hip arthroplasty, hip fusion, hip biomechanics*

Introduction

Stress fractures are caused by the repetitive muscular contraction which causes mechanical disturbance of cortical osseous trabeculae[1–3]. Although stress fractures of the pubic rami are rare, they have been reported as a cause of ipsilateral groin pain in patients after various surgical procedures of the hip[2,4,5] and in active young individuals, among which military recruits and athletes in particular[6–9]. Insufficiency fractures of ipsilateral pubic bone after total hip arthroplasty have also been reported[1,10–13]. To the best of our knowledge, there are no published case reports about stress fracture of pubic bone after contralateral total hip arthroplasty and longstanding ipsilateral hip fusion. We present a patient with bifocal pubic rami stress fractures after contralateral total hip arthroplasty for congenital hip dysplasia and longstanding ipsilateral hip fusion. The patient was informed that data concerning the case would be submitted for publication, and she consented.

Case Report

Right total hip arthroplasty was performed in a fifty--three-years-old woman with secondary osteoarthritis due to congenital right hip dysplasia and longstanding left hip fusion (Figure 1). The patient had bilateral congenital hip dysplasia which was a reason to perform multiple hip operations in her childhood: intertrochanteric right hip osteotomy at the age of six and left hip fusion at the age of eight. Fusion of the left hip was performed in 10° abduction, 10° flexion and in neutral rotation, but the left leg was 3 cm longer than the right as a result of previous operations and high dislocation of the right hip (Crowe IV)[14].

At the age of forty five she started to feel pain in the right hip and back pain during heavier activity, while at the age of fifty she presented with pain that interfered with the activities of daily living. Pain was measured using the Visual Analog Scale (VAS) as horizontal line 10 cm in length anchored by word descriptors at each end (no pain; zero and very severe pain; ten) and the patient marked the preoperative right hip pain to be at the point of 7.5 cm. Preoperative Harris Hip Score (HHS)[15] was 37.5 and body mass index (BMI) was 34.4 kg/m^2. Flexion in the right hip was possible from 20 to 40 degrees, abduction and adduction were up to 20° and hip could not be rotated. The range of motion (ROM) of the right knee

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Fig. 1. Preoperative X-ray of both hips. Left hip: longstanding (45 years) hip fusion, right hip: high hip dislocation, plate and screws 47 years after intertrochanteric osteotomy.

Fig. 2. Fully developed stress fracture of superior and inferior left pubic rami 11 months after right hip arthroplasty. Right hip: arthroplasty was performed with long stem to bridge the defect after plate and screw removal.

was 15° to 80° and the left knee ROM was 10° to 100°. The patient had intense chronic low back pain secondary to dextroconvex lumbar scoliosis and degenerative changes of lumbar spine, VAS=7.0, but without left hip pain.

A cementless right total hip arthroplasty was performed in January, 2003 (MP™ Reconstruction Hip Stem, Waldermar LINK GmbH & Co, Hamburg, Germany, HI™ Acetabulum, Intraplant, Cham, Switzerland). Intraoperatively, plate and four screws were removed (47 years after previous surgery). During the removal, all screws broke due to the poor material quality and because of screw fragments removal cortical defect of 5×1.5 cm was left on the lateral side of the right femur 6 cm bellow the tip of the greater trochanter. A long reconstruction femoral stem was used to bridge the defect (MP™ Reconstruction Hip Stem, Waldermar LINK GmbH & Co, Hamburg, Germany). Three cerclage wires were applied before implantation of the femoral component to prevent possible longitudinal fracture of the bone. For exposure a modified direct lateral approach was used[16]. Postoperatively right extremity was 2 cm longer compared to the left (intraoperative elongation was 5 cm). The patient started to ambulate on the third postoperative day with a 2 cm insert in the left shoe. Partial weight bearing was continued for four months, during which the patient had no pain in the right hip, but had low back pain with the same intensity as preoperatively (VAS 7.0). After four months of partial weight bearing patient stopped using crutches and was ambulating with full weight bearing for three months.

Approximately seven months after the right hip surgery (3 months of full weight bearing) the patient started to feel left groin pain during walking and standing. There was no history of trauma but she had »positive standing sign«[17] (frank pain or an inability to stand unsupported on the affected leg) that is highly suggestive of pubic rami stress fracture. Control x-rays, one year and eight months after surgery, indicated left superior and inferior pubic rami stress fractures (Figure 2). There was no sign of any other pathologic process in the left hemipelvis. Bone scan with 99mTc-methylene diphosphonate (MDP) detected an increased activity in the left pubic bones rami. The bone density test measured with dual energy x-ray absorptiometry (DEXA) of the lumbar spine was within the normal results (T-score of L1-L4=3.5). Because of degenerative changes of lumbar spine and possibility of false negative bone density test left forearm bone density test was performed, which did not show osteoporosis (distal radius T-score=1.0). The patient was treated conservatively with oral nonsteroidal anti-inflammatory analgetics and with the partial weight bearing during the 3 months period. Since she was not compliant the partial weight bearing was prolonged for another three months. x-rays were obtained at three months intervals. Two years after stress fractures x-rays showed complete healing (Figure 3). The patient had no residual left groin pain. At last control examination, five years and two months after surgery, the patient limped and used one crutch for long distance walk, had no pain in

Fig. 3. Two years after right hip arthroplasty healing of stress fracture occurred.

hips, had HHS for the right hip of 50.5 and had a low back pain (VAS 6.0). She had bilateral knee contracture (right knee flexion 15° to 80°, left knee flexion 10° to 100°). Further treatment plan includes conversion of left hip fusion to the total hip arthroplasty.

Discussion and Conclusion

The literature describes two types of stress fractures: fatigue fractures and insufficiency fractures[1,2,7]. Fatigue fractures occur when an abnormal muscular stress is applied to normal bone, while insufficiency fractures occur when physiological muscular stress is applied to osteoporotic bone or bone with deficient elastic resistance. Stress fractures usually involve bones of the lower extremities, most frequently tibiae (72%), femur (15%), feet (9%), fibula (3%), and only one percent (1%) in pubic bone and sacroiliac regions[3,18]. Cooper[19] identified several risk factors for development of insufficiency fractures that include female sex, osteoporosis, regional osteopenia, inflammatory and degenerative arthritis, radiation therapy, reconstructive surgery in the lower extremity and Paget's disease. In our patient female sex, degenerative arthritis (secondary to hip dysplasia[20], enhanced by contralateral hip fusion[21]) and reconstructive surgery in the lower extremity were detected as risk factors.

Pubic stress fractures have been described in active young individuals with normal bone, of them military recruits and athletes[6–9] in particular. There are a few case reports about stress fractures of ipsilateral pubic bone following total hip arthroplasty for primary hip arthritis or congenital hip dislocation and stress fracture of ipsilateral pubic bone following the total knee arthroplasty[1,5,10,11,13,22].

In a biomechanical study of load transfer of the pubic ramus due to pelvic inclination after hip joint surgery, Kaku et al.[18] detected biomechanical causes of pubic stress fracture, such as, loss of bone elasticity, increased activity after total hip arthroplasty, tensile stress from adductor or external rotator muscle and discrepancy in leg length. In our patient majority of causes were present either before the operation (loss of bone elasticity) or have developed after the operation (increased activity after total hip replacement and extremity with fused hip, which was preoperatively longer, became postoperatively shorter).

Standard bone density test (DEXA) on the lumbar spine did not show osteoporosis, but could be false negative because of the degenerative changes of lumbar spine. Our patient had no risk factors for generalized osteoporosis, except female sex and age[23]. For three years before the hip arthroplasty the patient was taking a hormone therapy because of the early postmenopausal symptoms which certainly reduced even a small risk for generalized osteoporosis.

Karol et al.[24] in their study described gait and function after intra-articular arthrodesis of the hip. Their patients had reduced cadence and step lengths, and the motion of pelvic and lumbar spine was excessive. They stated that the normal pelvis tilts posteriorly at the same time as the hip is in maximal flexion, and it tilts anteriorly during single limb stance in sagital plane. In the coronal plane the pelvis drops slightly during the swing phase while in the transverse plane the pelvis rotates slightly internally as the swinging limb advanced and rotates externally in the stance phase. In the case of hip arthrodesis, pelvic motion in sagittal plane is decreased and pelvic rotation in the transverse plane increased during walking. Rotation in the lumbar spine was also enlarged[12]. Walking pattern of our patient changed postoperatively. This was subjectively observed by the patient herself and the authors. Postoperatively, increased and pain free range of motion of the right hip (VAS 3) probably enabled longer step lengths which caused greater rotation of the pelvis, especially in the transverse plane. Since the lumbar spine, because of advanced degenerative lumbar changes, could not facilitate the rotation of the pelvis[25], pelvic girdle adjusted by creating additional »false« joint (where the bone was the weakest). This enabled longer step lengths and increased the right hip range of motion but produced a pain in the left groin area. This is only a speculation based on the previously published papers but probably all above mentioned factors contributed to some extent in developing stress fracture of the pubic bone by changed pelvic biomechanics[6,18,24,26,27]. Development of the stress fracture could have been prevented if the patient was operated simultaneously on both hips or if the left hip was operated shortly after the right one. In this way all negative biomechanical causes would have been eliminated. All our patients scheduled for conversion of the hip fusion to the hip arthroplasty undergo prolonged preoperative rehabilitation with special emphasis on isometric exercises for fused hip abductors and rotators. However, although here reported patient underwent preoperative strengthening, we have not performed simultaneous bilateral arthroplasty because even one side arthroplasty would have imposed great stress to the patient and it was believed it will lead to a very long and slow postoperative rehabilitation (especially 45 years of non utilizing left hip abductors). Left hip conversion from fusion to arthroplasty within 3 months after the right hip arthroplasty would probably be a better solution because the patient would sufficiently recover from the first surgery and stress fracture would not yet develop. Stress fractures have a good outcome with conservative management and usually heal within a few weeks[1,4,11,13]. In case of our patient control x-ray showed complete healing of pubic bone after two years.

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DVOSTRUKI PRIJELOM ZAMORA PREPONSKE KOSTI NAKON UGRAĐENE TOTALNE ENDOPROTEZE KUKA SUPROTNE STRANE I VIŠEGODIŠNJEG ZAKOČENJA ISTOSTRANOG KUKA

SAŽETAK

Ovim radom prikazana je bolesnica s dvostrukim prijelomom zamora preponske kosti koji je nastao nakon ugradnje totalne endoproteze kuka suprotne strane, a bolesnica ima prije više godina zakočen kuk sa strane prijeloma. Na osnovi ovog prikaza i do sada objavljene literature predložen je protokol liječenja različitih stupnjeva osteoartritisa kuka jedne strane i višegodišnjeg zakočenja kuka druge strane.