Femoroacetabular Impingement in Professional Ice Hockey Players: A Case Series of 5 Athletes After Open Surgical Decompression of the Hip

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Femoroacetabular Impingement in Professional Ice Hockey Players

A Case Series of 5 Athletes After Open Surgical Decompression of the Hip

Mario Bizzini,*† MSc, PT, Hubert P. Notzli,‡ MD, and Nicola A. Maffiuletti,† PhD
From the †Neuromuscular Research Laboratory, Schulthess Clinic, Zurich, Switzerland, and the ‡Orthopaedic Department, Ziegler Hospital, Bern, Switzerland

Background: Femoroacetabular impingement of the hip joint has been identified as a major cause for hip pain in athletes. Surgical open decompression of the hip has historically been proposed as the first treatment of choice. Functional outcomes in athletes after this procedure are unknown.

Purpose: To describe the functional and sport-related outcome 2 years after open surgical hip decompression in a group of young professional ice hockey players suffering from cam femoroacetabular impingement.

Study Design: Case series; Level of evidence, 4.

Methods: Five young professional ice hockey players (mean age, 21.4 y at follow-up) who suffered from cam femoroacetabular impingement were treated with open surgical decompression of the hip. The operation was performed by the same surgeon, and all athletes followed the same rehabilitation guidelines. Mean follow-up time was 2.7 years. Outcome measures were recorded as time to regain symmetrical hip rotation, regain preoperative core/hip muscle strength, return to team practice, and play at competitive level.

Results: Hip rotation range of motion was regained by a mean 10.3 weeks. Core and hip strength values reached preoperative levels by a mean 7.8 months. Return to unrestricted team practice with the ice hockey team was achieved by a mean 6.7 months, and athletes were able to play their first competitive game after a mean 9.6 months. Three athletes were able to perform again at the highest level and in international competitions. Two athletes had to return to minor league ice hockey.

Conclusion: Return to high-level ice hockey after open surgical decompression of the hip was possible in this series of 5 consecutive cases.

Keywords: femoroacetabular impingement; surgical open decompression; ice hockey; rehabilitation; return to play

Femoroacetabular impingement (FAI) of the hip joint has been identified as a major cause for hip pain in athletes. Decreased range of motion (ROM), and decreased performance in the athlete. Philippon and Schenker reported that 57 of 157 professional athletes who underwent hip arthroscopic surgery required decompression for FAI.

In ice hockey, the players may suffer from traumatic and overuse type of hip injuries. During skating (as a field player), the hip is mainly loaded in flexion, abduction, and external rotation. For the goaltender (often using the butterfly technique), the hip joint is stressed in flexion and internal rotation (end of range). The association of these combined movements and the presence of any abnormality of the femoral head-neck junction are potentially detrimental for the labrum and the acetabular rim. Although very little is known of the cause, the cam-type FAI is currently more frequently diagnosed in young elite ice hockey players (M. Bizzini et al, unpublished data, 2006).

Because of the severe hindrance to sports performance, open surgical dislocation procedures have historically been proposed as the first treatment option for FAI decompression.

The aim of this case series was to describe the functional and sport-related outcome 2 years after open surgical decompression of cam FAI in a group of young professional ice hockey players.
of the gluteus medius and the external rotator muscles, exposure of the hip capsule while respecting the integrity position. The trochanteric osteotomy approach allows for
mary, the patient is placed in a stable lateral decubitus
2 22 Goaltender Yes (1st team) Right 18 36
3 22 Forward Yes (Junior) Right 9 33
4 22 Forward Yes (1st team) Right 13 32
5 20 Defender Yes (Junior) Right 12 20

MATERIALS AND METHODS
Patient Population
This prospective case series included 5 young players (mean age, 21.4 y; range, 20-22 y) of a Swiss professional ice hockey team with diagnosed cam FAI. These athletes (1 goaltender, 1 defender, and 3 forwards) were playing for the same team in the professional ice hockey league in Switzerland. The 5 players were regularly selected for the Swiss national teams (first junior selections, then main national team). The athletes were suffering from unspecific hip/groin pain for an average time of 13 months (range, 9-18 mo) from onset to surgery (Table 1). They all had failed conservative treatment; massage and gentle traction of the hip joint were helpful in a momentary reduction of the symptoms, while forceful stretching and ROM exercises exacerbated the symptoms. The loss of ROM in hip rotation (especially internal rotation) was the main performance-limiting factor. The FAI was first misdiagnosed, and the signs and symptoms were classified under “groin pain.” By the time the athletes were finally looked at by a hip specialist, they were no longer able to play. Clinical examination showed a painful hip joint with reduced ROM in internal rotation and a positive impingement test result (symptom reproduction with a combined maneuver of passive flexion, adduction, and internal rotation). All athletes underwent conventional magnetic resonance (MR) arthrography (with gadolinium contrast) and plain radiography (2 planes: anteroposterior and crosstable lateral views) before surgery. In all cases, cam FAIs (reduced femoral head and neck offset) with associated labral lesions (located primarily anterosuperior) were diagnosed, and surgical treatment was planned. The operations were performed between 2003 and 2005.

Surgical Technique
The athletes underwent a surgical open hip dislocation; this technique is described in detail elsewhere. In summary, the patient is placed in a stable lateral decubitus position. The trochanteric osteotomy approach allows for exposure of the hip capsule while respecting the integrity of the gluteus medius and the external rotator muscles, including the piriformis. The gluteus minimus is dissected from the capsule. A Z-shaped capsulotomy exposes the hip joint, which can be examined for an intra-articular bony impingement. If necessary, the ligamentum teres is cut to expose the cartilage of the acetabulum and the femoral head itself. In cases with a labral lesion, the revision of the labrum is done first. The damaged areas of the labrum are completely detached from the acetabular rim, and the excess bone is, if possible, trimmed back to the level of stable cartilage. Unstable cartilage has to be removed, and therefore areas uncovered by cartilage may remain (here microfracture may be indicated to stimulate cartilage repair). Finally, a normal concave neck contour is re-created by subsequent osteotomies under careful protection of vessels responsible for the femoral head perfusion (medial femoral circumflex artery). After reduction of the hip joint, the mobility is tested, especially in the combined flexion/adduction/internal rotation position, to confirm that the bony impingement does not exist anymore. Then the capsular flaps are loosely reaproximated with an absorbable suture, and the osteotomized greater trochanter is fixed with two 3.5-mm cortical screws.

In the 5 athletes (6 hips), the surgical treatment consisted of removing the nonspherical portion of the femoral head and creating a normal waist at the femoral head-neck junction by reducing the bone as far as the intertrochanteric region (Figure 1 A and B). In all cases, an additional refixation of the labrum to the acetabular rim (after resection arthroplasty of the excessive anterior rim) with anchored sutures was performed first (Figure 1 C and D). None of the hips had articular cartilage lesions requiring debridement or microfracture. The operations were performed by the same orthopaedic surgeon.

Rehabilitation
The 5 athletes followed the same rehabilitation guidelines and were supervised by the same physical therapist. The rehabilitation was divided into 5 phases. Phases II to IV were not strictly time-based but rather dependent on the individual progress of the patient during training. The return to sport (phase V) was allowed only if important criteria (ROM, strength, sport-specific neuromuscular control) were met (M. Bizzini et al, unpublished data, 2006).
Phase I or “Maximal Protection Phase” (0 to 6-8 Weeks).
In this phase, the patient was allowed to ambulate toe-touch weightbearing. The goals were optimal healing of the trochanter osteotomy and healing of the labrum and of the soft tissues.16

Active ROM exercises were not performed, and passive flexion was limited to 70°. In the first postoperative week (hospital stay), a passive motion device was used.16

Phase II or “Controlled Ambulation Phase” (9-12 Weeks).
The phase lasted until the patient could walk without crutches, with minimal symptoms, and minimal limping. Passive and active ROM exercises (without forcing) were begun. Sensorimotor exercises2 to promote neuromuscular control of the pelvis and lower extremity were emphasized, and strengthening exercises for the abductors were initiated.

Phase III or “Controlled Progression Phase” (13-18 Weeks).
The goal of this phase was to improve the neuromuscular stabilization and to begin the sport-specific strength and endurance training. Abductor muscle strengthening was also intensified, and weight training was started.

Phase IV or “Intensive Training Phase” (19-24 Weeks).
This phase included an intensive training of the different parameters: flexibility, coordination, agility, strength, and endurance. The athlete was allowed to follow an individual program on the ice, where the basic skating moves were trained.27

Phase V or “Return to Sport” (From Week 25). This phase included the unrestricted return to practice with the ice hockey team and later the full return to the game or playing a competitive ice hockey match.

Outcome Measures

The athletes were followed for an average of 2.7 years postoperatively (range, 1.8-3.8). Hip ROM for internal/external rotation was examined with the subject in a prone position on a padded table with the test knee flexed to 90° and the hip in neutral rotation.5 Range of motion measurements were performed using a goniometer.13

Core and hip muscle strength was documented with a test battery adopted by the Swiss Olympic Medical Centers. The tests for the ventral, lateral (Figure 2), and dorsal core/hip muscle chains were proven to be valid and reliable.4,26

The exact times to regain hip ROM, to match the preoperative core/hip muscle strength, to unrestricted team training on the ice, and to the first appearance in a competitive game were recorded by the sport physical therapist supervising the postoperative rehabilitation and training of the athletes.

An oral numeric 0-to-10 rating scale28 was used throughout the rehabilitation process to document pain. The athletes
were allowed to return to team training and to full competitive game only if they were pain-free.

The present study was approved by the local Ethics Committee for Human Subjects Research.

RESULTS

The demographic characteristics of the athletes are presented in Table 1, while the clinical functional outcomes are listed in Table 2.

Return to preoperative ROM (internal and external rotation) of the involved hip joint was achieved at a mean of 10.3 weeks (range, 8-13) after surgery. The patients reached their preoperative core/hip muscle strength level by a mean of 7.8 months (range, 5.5-12). The athletes were able to return without symptoms (pain score = 0) to unrestricted team practice on the ice at a mean of 6.7 months (range, 5.5-9.5) postoperatively. The players could participate in their first competitive game after a mean of 9.6 months (range, 7-14).

At the time of follow-up (mean, 2.7 y), 3 patients were fully reintegrated in the team and playing in the Swiss ice hockey professional league. These 3 players were selected again for the Swiss national teams. The other 2 players (1 of them had surgery on both hips), also pain- and symptom-free, were not able to reach their preoperative level of performance and were sent to the farm team (minor league ice hockey).

DISCUSSION

Few studies\textsuperscript{1,20} have analyzed the outcomes in individual patients after surgical open decompression for FAI treatment. Beck et al\textsuperscript{1} presented a retrospective case series of 19 FAI patients treated with the open bony resection procedure (follow-up, 4.0-5.2 y). Murphy et al\textsuperscript{20} reported the results of 23 FAI patients treated with open bony debridement (follow-up, 2-12 y). In these studies, good results were found in patients with early degenerative changes not exceeding grade I osteoarthrosis of the hip joint. The Merle d’Aubigné and Postel Hip Score were used as outcome measures (typically used in total hip arthroplasty follow-ups), and no details concerning the (sports) activity level of these patients (average age, 35-36 y) were given.

There are no published studies on the functional outcome after FAI treated with open surgery in athletes. When dealing with high-level athletes, not only is the “return to play” important, but even more so, the return to unrestricted training and competitive sport are crucial (M. Bizzini et al, unpublished data, 2006).\textsuperscript{3}

In this case series, the 5 ice hockey players were able to return to high-level sports, on average, more than 9 months after surgery. Interestingly, there was no difference concerning outcomes between the goaltender and the other 4 field players. A goaltender’s hip is usually significantly more stressed than a field player’s, but in this small group, the goaltender was among those able to return to play at the highest level.

Although Ganz et al\textsuperscript{9,10} showed that the surgical dislocation of the hip with proper technique is a safe procedure, this represents a major operation. Bone (trochanter osteotomy) and soft tissue (dissection of the gluteus minimus, capsulotomy) interventions are relevant, and the healing of these structures needs time. These considerations may explain why the athletes needed several months (more than 6 on average) before regaining their preoperative core/hip muscle strength.

\begin{table}[h]
\centering
\caption{Postoperative Clinical and Functional Outcomes\textsuperscript{a}}
\begin{tabular}{|l|c|c|c|c|c|}
\hline
 & 1 & 2 & 3\textsuperscript{b} & 4 & 5 \\
\hline
Time to symmetrical ROM (rotation), wk & 8 & 11 & 10, 11 & 9 & 13 \\
Time to regain preoperative core/hip muscle strength, mo & 5.5 & 6.5 & 6, 9.5 & 7.5 & 12 \\
Time to unrestricted ice training with team, mo & 5.5 & 6 & 6.5 & 6 & 9.5 \\
Time to first competitive game with team, mo & 7 & 9 & 10 & 8 & 14 \\
Playing with team at FU (Y/N) & Y & Y & N & Y & N \\
Return to national team (Y/N) & Y (Jr WC ‘05, ‘06) & Y & N & Y (WC ‘05) & N \\
\hline
\end{tabular}
\textsuperscript{a}ROM, range of motion; FU, follow-up; WC, World Championship of the International Ice Hockey Federation; Y, yes; N, no.
\textsuperscript{b}Bilateral hip surgery (with a 7-month delay between the 2 interventions). There were no intensive training or games between the first and second surgery.
\end{table}
Philippon and Schenker suggested that the operative trauma sustained during the open procedure might make it difficult for high-level athletes to return to play. The arthroscopic surgical approach seems to reduce postoperative morbidity and provide a shorter rehabilitation time and quicker return to play for athletes. Enseki et al. in discussing the rehabilitation after hip arthroscopic procedures, stated that “typically, athletes can return to a competitive environment in 10 to 32 weeks.” However, there is so far no publication on the outcomes in athletes after arthroscopic surgery for FAI decompression.

In this case series, the athletes were able to return to competitive ice hockey. But the necessary amount of rehabilitation and sport-specific training was considerable, and not every athlete could reach his preoperative playing skill and performance. Two field players and the goaltender did return to high-level ice hockey performance (including not only the Swiss professional league, but also the Swiss National Team). The 2 other athletes were able to compete in second division, but their performance level was not enough for the professional league.

CONCLUSION

Historically, treatment for FAI consists of an open surgical decompression of the hip. Taking the unrestricted full return to competitive sports as a criterion, this type of surgery, combined with an intensive rehabilitation program, was successful in 3 out of 5 ice hockey players suffering from cam FAI. The other 2 were not able to reach their previous playing level. The return to play at competitive level was reached after 9.6 months. The hip musculature strength needed several months before reaching preoperative levels, and this was certainly a reason for the length of rehabilitation and a concern for professional athletes. Longer-term outcomes for open surgical decompression of the hip in high-level athletes are still unknown.

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