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Original article

Capsular closure after hip arthroscopy: our experience

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Summary. *Background and aim of the work:* In the last decade, arthroscopic treatment of hip diseases has significantly spread and evolved and currently it represents the gold standard for the treatment of femoral-acetabular impingement. In the recent years, the function of the joint capsule (and therefore the results of an arthroscopic capsulotomy) has been hugely developed, opening a heated debate. The Literature is still torn about the need for a capsular suture, but more recent studies are more oriented in its execution at the end of the surgical procedure. According to these recent studies, the joint capsule performs an essential function of primary stability, and its closure is therefore necessary to restore the native anatomy and physiology. Nevertheless, capsular management remains a controversial topic. This is a retrospective study with the aim of assessing the influence of capsular suture on the patient's functional outcome in a cohort of patients with femoral-acetabular impingement arthroscopically treated. *Hypothesis:* Our hypothesis is that an adequate capsular suture positively influences the patient's functional outcome. *Methods and Results:* 50 patients treated with hip arthroscopy for femoral-acetabular impingement have been retrospectively enrolled at the Orthopaedic Clinic of Academic Hospital of Udine during a period of two-years (2017-2018); collected data have been analysed and compared with a retrospective model. Patients have been divided into two equivalent groups, 25 treated with capsular suture, 25 without performing the suture. Patient's post-operative functional outcome has been analysed using the modified Harris Hip Score (mHHS), the Non-Arthritic Hip Score (NAHS) and the Hip Outcome Score-Sport Scale (HOS-SS). The functional outcome in patients where capsular sutures were performed was better than in non-sutured patients, in all three analysed scales. *Conclusions:* Capsular suture with a single side-to-side stitch at the end of the procedure can positively influence the patient's functional outcome. (www.actabiomedica.it)

Key words: Hip arthroscopy, capsular suture, capsulotomy, femoral-acetabular impingement

Introduction

In recent decades, hip arthroscopy has considerably grown as a treatment of diseases affecting the coxo-femoral joint and its surrounding structures. This increase is likely related to the improvement of surgical techniques, the raised surgeons' interests about this approach and, finally, the evolution of the diagnostic techniques and dedicated tools. Currently, hip arthroscopy represents the gold standard for the treatment of femoral-acetabular impingement (FAI).

Hip arthroscopy for the treatment of FAI requires some precautions: firstly, mini-accesses for specific portals (the most used are the Antero-Lateral and the Mid-Lateral); secondly, a minimally invasive management of extra-articular tissues to be less demolitive as possible, but also to obtain an adequate view of the joint capsule. Moreover, the best possible capsulotomy must be performed to obtain a good manoeuvrability of the instruments, a better exposition of the intra-articular structures (including the acetabular labrum) and an acceptable workspace for the treatment of impingement.

If the utility of an adequate capsulotomy is well known, the Literature is not univocal on the impact of the capsulotomy and its possible repair at the end of the procedure, in terms of possible complications and restoration of the biomechanical stability (1, 2).

Some previous studies (some of which dated), did not find significant differences comparing suture and non-capsular suture strategy (3)

Whereas, several recent studies have reopened the debate which in the last years has been considerably inflamed. In fact, recent authors have demonstrated how capsular suture at the end of the operation determines biomechanical and functional benefits to the joint, positively influencing the patient's post-operative outcome, including range of motion, quality of life, satisfaction, pain and minor complications and hence reintervention. (4, 5). These are the main reasons why capsular repair has increasingly spread despite the lack of high-level evidence. Unfortunately, is not yet clear whether capsular suture should be performed as a routine procedure or not.

Joint capsule anatomy: The joint capsule consists of three external and one internal ligaments whose interconnections provide biomechanical constraints during movement through modifying forces about the hip. (6) The Iliofemoral ligament is the thickest and represents the primary limit to hip hyperextension and external-rotation. This ligament is made up of two portions, one lateral more vertical, and one medial more oblique. The primary function of the second external ligament, the Pubofemoral, is to limit abduction and external-rotation. The Ischio-femoral ligament finally effectively limits hyperextension (7). The internal ligament is the Zona orbicularis, a synovium-lined composed of circumferentially oriented fibres, which aid in resisting hip distraction, thereby stabilizing the femoral head and neck (8). Although the three external ligaments constitute a single capsular structure, the greatest mechanical influence is given by the Ileo-femoral ligament, which represents a critical component for the biomechanics of the hip, determining stability and limiting distraction or joint translation beyond the physiological range of motion. The joint capsule determines a non-dynamic primary stability of the joint (9-11). Further functions are joint sealing, proprioception and pain sensitivity (12). These features have been studied for a long time, especially in pathological pictures such as congenital hip dysplasia, with its pathogenesis of laxity and capsular instability (13).

Operating technique: Our operating technique involves the patient under General anaesthesia placed on an orthopaedic traction bed with the foot intrarotated about 15°. An extra-articular approach without traction as described in a previous paper by Di Benedetto et al. (14) is preferred. Two accesses are performed, the Antero-Lateral and Mid-Lateral Access. Besides, A mini-toilet of extra-articular tissues is executed.

After the long use by the surgeon of the interportal capsulotomy and T shape capsulotomy, our current technique involves a single incision centred on the femoral neck following the course of the capsular fibers up to the limit of the acetabular labrum (Fig.1-2); this new manoeuvre determines a less invasive effect on the Iliofemoral ligament, a lesser need to touch the extracapsular tissues, a lower risk of injury to the intra-articular structures and particularly of the acetabular

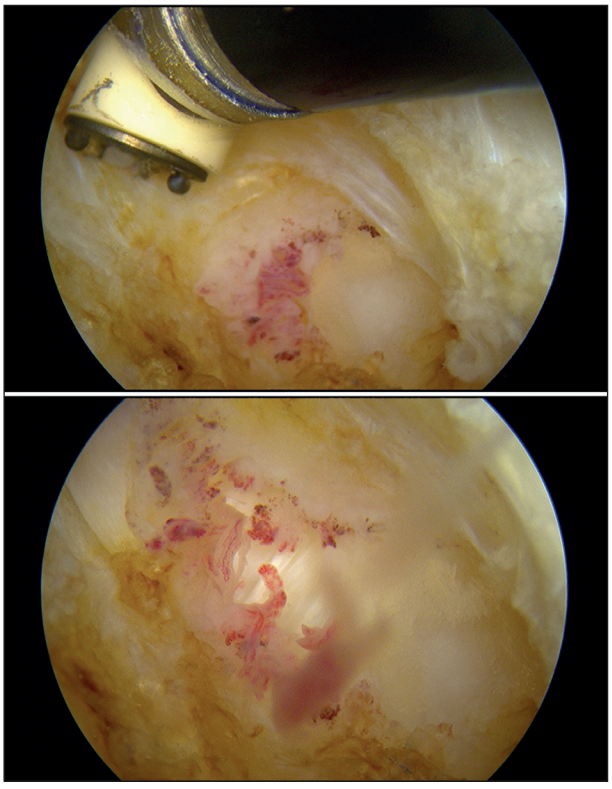

Figure 1–2. Capsulotomy with a single longitudinal incision from distal to proximal up to the acetabular labrum

lip. At the end of the surgery, a suture with a single side-to-side stitch with high resistance wire (14-15) is made to obtain a complete closure (fig. 3-4). The treatment lasts about 60 minutes with a maximum of 15 minutes in legs' traction. The aim of the study is to evaluate the clinical and the functional benefit of capsular closure after hip arthroscopy.

Methods

The retrospective study was performed on a group of 50 patients treated with hip arthroscopy in the period between February 2017 and October 2018. All the operations were performed by the same expert surgeon. Inclusion criteria were: clinically confirmed FAI diagnosis with dedicated radiographs and MRI study, age between 15 and 35 years, pre-operative pain for at least 6 months not regressed with physical, physiotherapic and analgesic therapies. Exclusion criteria included: evidence of hip dysplasia, coxa profunda or coxa protrusa, signs of advanced osteoarthritis, results of traumatic events such as fractures, previous local surgery, severe acetabular deformity, concomitant presence of other joint and extra-articular disorders, any intra-operative complications, arthroscopic surgery on the contralateral limb within the year.

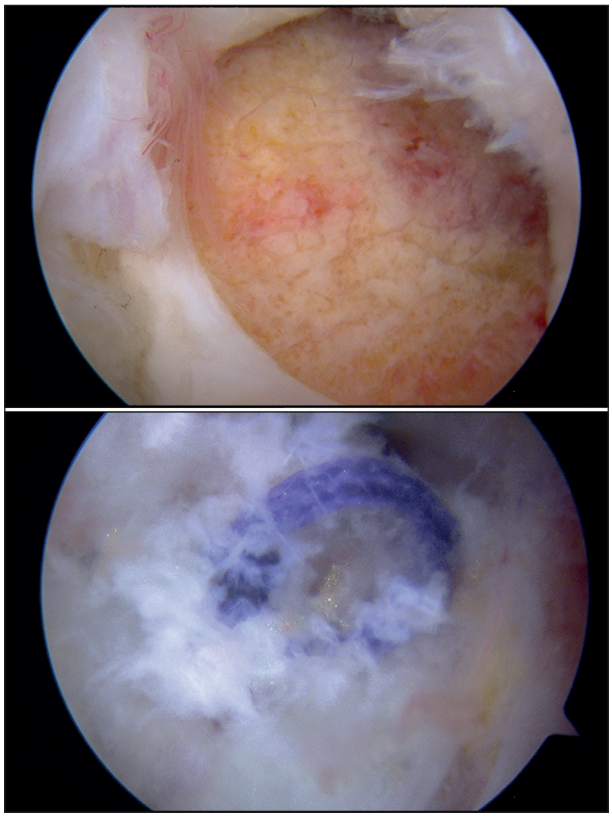

Figure 3–4. Suture of the capsule with a single side-to-side stitch

Among the 50 patients considered in the study, joint capsule closure procedure was not performed at the end of surgery in 25 of them; the second group included 25 patients who were treated with capsular suture with a side-to-side stitch, as previously described.

All patients underwent usual follow up at 2 weeks from the index procedure, at 45 days, at 3 months, at 6 months and at 1 year. Data have been collected 1 year after the surgery through a face-to-face interview filling in the modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS) and Hip Outcome Score-Sport Scale (HOS-SS).

Continuous variables are presented through mean and standard deviation (SD); variables' distribution was assessed by the Shapiro-Wilk test. Group comparisons (non capsular closure group vs capsular closure group) were performed through Wilcoxon rank-sum (Mann-Whitney) test or two sample t-test as appropriate. Intra-group comparisons (before and after surgery) were based on paired t-test or Wilcoxon signed-rank test as appropriate. An α-level equal to 0.05 was assumed as guide for significance. All analysis were perfomed using STATA software version 13 (StataCorp, College Station, TX).

Results

All patients enrolled in the study (50 hip arthroscopy procedures) were examined for the treatment of the FAI. Both groups included 13 females and 12 males, the average age was 26 years (age range 15-35). The mean time for surgery was 55 minutes (range 40-72 minutes) for the non-capsular closure groups and 62 minutes (52-80 minutes) for the capsular closure group. The functional outcomes were evaluated 1 year after the operation with the mHHS, NAHS and HOS-SS. No patients needed additional procedures and no complications occurred in both groups.

The increase in the functional results, from pre-operative to post-operative (1 years FU), occurred in all patients of both groups and for all scales (Tab. 1-2). In both groups all scores at 1 year evaluation showed an increase statistically significant compared to pre-surgery evaluation.

As regards the analysis of the variation between pre and post surgery in the two groups, only in the mHHS score the "Capsular closure" group showed statistically significant increases on average higher than the comparison group. (α-level 0.05).

Tab.1 Mean of m-HHS, NAHS and HOS-SS pre-surgery and at 1 year after surgery for each group. NS (non capsular closure group); S (capsular closure group)

Discussion

During the last decade, the frequency of arthroscopic hip operations has increased exponentially; this procedure has become the standard technique for the treatment of non-arthritic intra and extra-articular pathologies of the hip, in particular of the femoral-acetabular impingement. In conjunction with the improvement of the surgical technique, a heated debate has opened regarding the instability of the joint capsule following the procedure. The pivotal questions of the debate are whether the capsulotomy determines an instability of the joint or not and whether a possible capsular suture restores the pre-intervention anatomy

Table 1. Mean and standard deviation of m-HHS, NAHS and HOS-SS for each group. NS (non capsular closure group); S (capsular closure group)

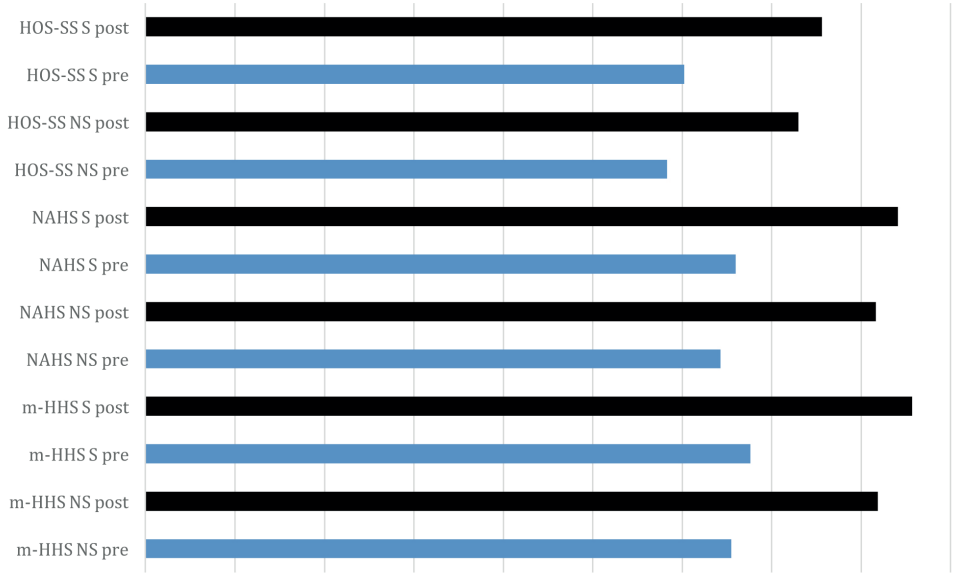

Table 2. Mean and standard deviation of m-HHS, NAHS and HOS-SS for each group. NS (non capsular closure group); S (capsular closure group)

	m-HHS NS pre	m-HHS NS post	NAHS NS pre	NAHS NS post	HOS-SS NS pre	HOS-SS NS post
Mean	65,48	81,88	64,24	81,64	58,32	73
Std. Deviation	2,786	2,027	2,976	1,8	4,516	5,115
	m-HHS S pre	m-HHS S post	NAHS S pre	NAHS S post	HOS-SS S pre	HOS-SS S post
Mean	67,6	85,68	65,96	84,12	60,2	75,6
Std. Deviation	1,555	3,198	2,371	2,789	3,571	3,958

and physiology, thus promoting the patient's post-operative outcome.

The issue is still open; the complexity and diversity of the variables in the field do not allow the use of univocal criteria to obtain homogeneous and comparable results (16,17). Currently the execution of the capsular suture is subject to the surgeon's ability and discretion, and there are no standard criteria (pathological and personal of the patient) that suggest the execution of this practice.

As anticipated, the Literature is not yet in agreement.

In some studies, the clinical benefits of capsular suture are not proven and do not demonstrate significant outcome differences between if the suture is performed (18). Ekhtiari et al (12) concludes that there is no evidence that capsular suture has long-term influences on joint stability.

Recent studies highlight how capsular suture promotes the well-being of soft tissues, prevents postoperative dislocations or dislocations, limits the development of heterotopic ossifications and increases functional outcome (19-20). Thaunat et al. this year he performed a retrospective study on functional outcome, demonstrating how capsular suture has clear positive effects. Abrams et al (19), studying the effects of capsulotomy on joint ROM, showed how repair restores the physiological rotational profile.

Myers et al (20), performed a study in cadavers, demonstrating that the joint capsule plays an important role in stability and that injury to the Iliofemoral ligament leads to an increase in anterior translation. Khair et al (21), again with studies in cadavers, concluded that joint stability depends on the size of the capsulotomy and on the possible post-surgery suture.

Nho et al (6) considers complete capsular suture an essential part of arthroscopic surgery to obtain an adequate functional outcome. Baha et al. (4) concludes that adequate repair restores range of motion and joint translation close to native levels, thus suggesting the execution of the capsular suture.

Our study is certainly in line with the most recent works (5). Our study has several limitations, including the fact of being a retrospective study, the number of patients, not having considered further variables in the selection and classification of patients. Moreover, the data obtained are not statistically significant except for the m-HHS score, but it could be a first step to deepen the subject. In any case further studies and analyses are necessary with more data to obtain an adequate result.

Conclusions

In conclusion, considering the limitations of our study, despite the conflicting opinions and the lack of clarity in the Literature, we still recommend the execution of the capsular suture at the end of the procedure, and we act to encourage this practice to become routine.

As it has been shown in surgery on other joints (22), minimizing soft tissue trauma and restoring native anatomy and physiology are principles that must also guide this surgery.

It is our opinion that, since it is a quick, easy, painless and minimally invasive procedure, it should be routinely adopted.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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