

Loss to follow-up: initial non-responders do not differ from responders in terms of 2-year outcome in a hip arthroscopy registry

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ABSTRACT

Loss to follow-up in registry studies is a problem due to potential selection bias. There is no consensus on the effect of response rate. The aim of this study was to compare patient-reported outcome measures (PROMs) between responders and initial non-responders (INR) in a hip arthroscopy registry and to examine whether demographics affect the response rate. Data from hip arthroscopies performed at two centres in Gothenburg were collected and the patients were followed up with PROMs. The follow-up was a minimum of 2 years after surgery. All 536 patients who underwent primary hip arthroscopies during 2015 and 2016 and had recorded pre-operative PROMs were included. A total of 396 patients completed the follow-up and were labelled 'Responders' (R) and 107 patients responded after reminders were sent and labelled 'Initial non-responders' (INR). The mean time of follow-up was 24.7 ± 2.9 and 42.5 ± 7.0 months for the R- and INR-group, respectively. There were no differences between the two groups at the follow-up for the Copenhagen Hip and Groin Outcome Score, European Quality of life 5 dimensions questionnaire, EQ-VAS, International Hip Outcome Tool or a visual analogue scale for hip function. A larger proportion of R was satisfied after hip arthroscopy compared with INR (86% versus 70%, $P = 0.0003$). INR were younger than responders (31.5 ± 12.5 versus 35.6 ± 12.7 years of age). The conclusion of the study was that there were no differences between R and INR at the follow-up across the PROMs except patient satisfaction, where responders were more satisfied.

INTRODUCTION

Arthroscopic hip surgery is an increasing field in orthopaedics and the surgical procedures used in hip arthroscopy are developing [1]. There is also an increasing number of publications in this area [2]. A substantial part of science on the outcome of the arthroscopic hip surgery is based on data from local databases or registries [3–6]. With a high number of hip arthroscopies being performed, it is important that registry

data are of high quality. High response rate in patient follow-up is considered a contributing factor to scientific quality [7]; however, one of the main concerns in patient registries is the low compliance in follow-up and many studies either have low response-rate or do not report on the response-rate, potentially affecting the results. To the best of knowledge of the authors, there is no study published evaluating the effect of non-response bias in hip arthroscopy.

Loss to follow-up can compromise the external validity and reliability of a study. Although loss to follow-up should always be minimized, there is no consensus in the literature on how much loss to follow-up can be accepted without affecting the validity of the study [8]. Some studies suggest <5% loss to follow-up is necessary to prevent bias, while others accept up to 20% missing data, depending on the type of study [7, 9, 10]. For many years, the acceptable standard for follow-up rate has been considered to target 80% of the study population [11]. Several suggestions have been advocated on how to reduce non-responders bias [11, 12], such as using more than one survey modality (email and postal mail), several reminders and contact personalization [7, 12]. A few studies have shown that patients who respond late to questionnaires have been associated with poorer outcomes compared with responders [13, 14]. While other studies have reported no differences in the functional results between responders and non-responders [11, 15, 16]. The degree to which high response rates actually reduces non-response bias has, however, been the subject of debate. A common and acceptable method to evaluate non-response bias is to compare answers at follow-up between early responders and late responders [7].

Another important aspect is whether the baseline and patient demographics differ between responders and initial non-responders (INR) to conclude whether the distribution of responders is a reasonable representation of patients undergoing hip arthroscopy. Previous studies evaluating loss to follow-up have reported that patients with a higher socioeconomic status, older age and female gender are more inclined to respond to follow-ups [17–19]. To draw conclusions from registry studies, it is crucial to be aware of possible biases and imprecisions due to loss to follow-up.

The primary aim of this study was to compare patient-reported outcome measures (PROMs) between responders and INR after arthroscopic surgery. The secondary aim was to compare demographic with surgical data between the two groups.

The hypothesis was that there would be no differences in outcomes between responders and INR.

MATERIALS AND METHODS

All consecutive patients undergoing hip arthroscopic treatment between January 2015 and December 2016 who had registered pre-operative PROMs were included prospectively in the study. The surgical procedures were performed at two different hospitals by three high-volume surgeons. At these institutions, all arthroscopic surgeries are included in a local hip arthroscopic registry [4]. Indication for hip arthroscopy was based on patient history, radiological findings and patient examination. All patients in the registry

were asked to fill out PROMs in a web-based questionnaire pre-operatively and are further followed up 2 and 5 years after surgery. The cut-off for follow-up in this study was chosen as 2 years to increase the study population since data for 5-year follow-up were not available. Registry data prior to 2015 were deemed to be too old as the difference in follow-up would have become too large between the two groups. The PROMs included in the registry are the Copenhagen Hip and Groin Outcome Score (HAGOS) [20], the European Quality of life 5 dimensions questionnaire (EQ-5D) and the EQ-VAS [21], the International Hip Outcome Tool (iHOT-12) [22], the Hip Sports Activity Scale (HSAS) [23] and a visual analogue scale (VAS) for hip function. At the follow-up, the patient also responded to a single question regarding patient satisfaction (yes/no). The exclusion criteria were a previous surgery to the treated hip or a re-operation, including a total hip arthroplasty (THA).

The cohort was divided into two groups, ‘responders’ (R) and ‘non-responders’ (NR) depending on if the patient had responded or not at the regular 2-year follow-up. A patient was considered R if any data were completed and NR if no data were completed. Demographic data such as gender, age, symptom duration and body mass index (BMI) were collected. Surgical data, such as surgical procedure and bilateral surgery, were also included.

The NR-group was contacted by phone and several additional reminders were then sent to the patients by email. The reminding emails included a link to the web-based questionnaire which was completed by the patients online. The patients were operated in 2015 and 2016 and the reminders were sent in 2019. The time passed from the sent reminders to when the patients had answered where within a period of three months. The contact was made by an unbiased observer, neither involved in the surgery nor the regular follow-ups. The contacted patients who responded to the reminding questionnaire were labelled INR. The contacted patients who did not respond to the additional questionnaire were labelled unavailable (U). [Figure 1](#) describes the flow of the included patients.

Both the mean change in PROMs from pre-operative to the follow-up and the results at the follow-up were compared between the two groups. Not all patients replied to all included PROMs. If data was missing from a patient to a certain PROM at either the pre-operative score or at the 2-year follow-up, this PROM was excluded for this specific patient. In case of missing demographic data, the patient was excluded from the particular analysis.

Ethical approval was obtained from the Regional Ethical Review Board in Gothenburg 071-12 and 2019-02990.

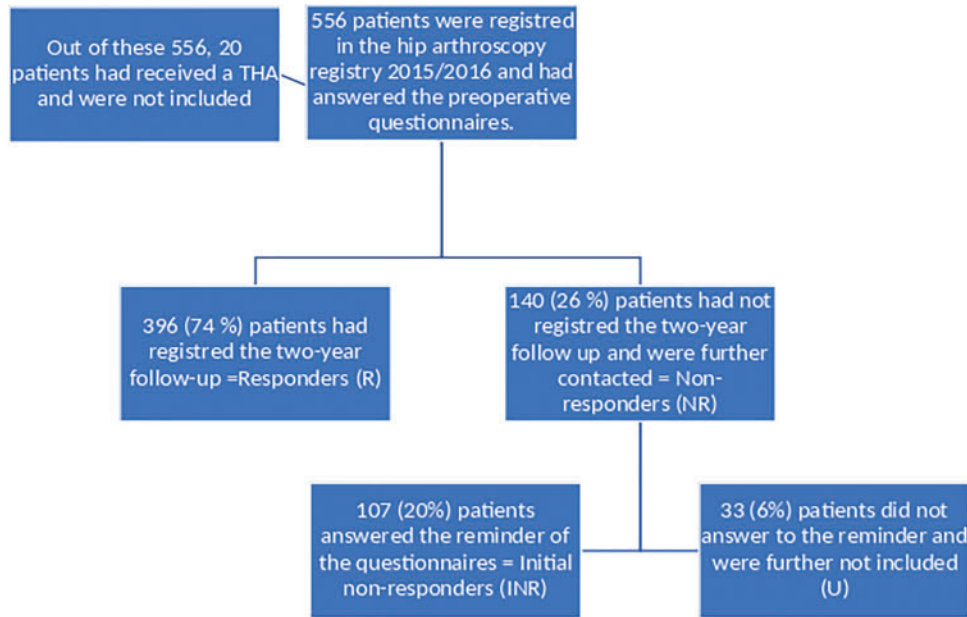


Fig. 1. Flowchart of included patients. INR, initial non-responders; R, responders; THA, total hip arthroplasty; U, unavailable.

Statistical analysis

The statistical analysis was performed using the Statistical Analysis System (SAS, version 9.1) for Windows. For categorical variables, count and proportion were presented and for continuous variables, mean and standard deviation (SD) were presented. For comparisons between the R- and the INR-group, the Fisher’s exact test was used for dichotomous variables and the Fisher’s Non-Parametric Permutation test was used for continuous variables. To determine correlations between variables, a linear regression analysis was performed. A *P*-value of <0.05 was considered statistically significant.

RESULTS

A total of 536 patients were included in the study. Of these 396 (74%) patients had responded to the primary follow-up and were allocated to the R-group. After reminders,

another 107 (20%) patients responded and constituted the INR-group. A total of 33 (6%) patients did not respond to the reminders and were excluded from the study. The mean follow-up length was 24.7 ± 2.9 months for the R-group and 42.5 ± 7.0 months for the INR-group. The R- and INR-groups combined covered a response rate of 94%. The mean age was higher for R (35.6 ± 12.7) than INR (31.5 ± 12.5) ($P = 0.002$). There were no differences in terms of patient gender or symptom duration between the two groups (Table I).

The distribution of the surgical procedures in the study cohort is presented in Table II.

A larger proportion of the R-group was satisfied with their surgical treatment at follow-up compared with the INR-group (86 and 70% respectively, $P = 0.0003$; Table III). There were no differences in PROMs at follow-up between the two groups in terms of the HAGOS, EQ-

Table I. Demographic data comparing responders with initial non-responders

	Responders	Initial non-responders	P-value
Age (years) (at surgery), mean (SD)	35.6 (12.7)	31.5 (12.5)	0.002
Female/male, <i>n</i> (%)	127/269 (32/68)	25/82 (23/77)	0.1
Symptom duration (months), mean (SD)	46.3 (48.4)	38.4 (45.4)	0.14
BMI, mean (SD)	24.6 (3.2)	25.2 (4.0)	0.18
Bilaterals, <i>n</i> (%)	152 (38)	51 (48)	0.1

BMI, body mass index; SD, standard deviation; *n*, number.

SD, EQ-VAS, iHOT-12 and VAS. The absolute results at follow-up and the change from pre-operatively to follow-up are presented in Table IV. There was a difference in HSAS before onset of symptoms and during adolescence between the groups. There was no significant difference in the HSAS at the follow-up after surgery (Table V). In the linear regression analysis, higher age was correlated with a

lower HSAS before onset of symptoms and during adolescence ($P < 0.0001$).

DISCUSSION

The main finding in this study was that there were no statistically significant differences between the R- and INR-groups regarding patient-reported hip function, reflected by the HAGOS, the iHOT-12, the EQ-5D, the EQ-VAS and the hip function VAS at the follow-up after hip arthroscopy. The PROMs used in this study cover different aspects of hip outcome suggesting similar results in patients undergoing hip arthroscopy, regardless of whether or not the patients respond to the follow-up. This is an important finding since several studies are based upon the registry and the conclusions drawn from these studies are thus considered valid [6, 24, 25]. In addition, studies

Table II. Surgical procedures presented as percentage

Surgical procedures	Responders (%)	Initial non-responders (%)	P-value
CAM	23.6	29.1	0.17
Pincer	2.0	1.3	0.74
Both CAM and pincer	68.1	63.3	0.29
Internal snapping hip	0.6	0.0	0.99
External snapping hip	2.0	1.9	0.99
Labrum lesion	6.8	4.4	0.35
Other	2.2	4.4	0.40

'Other' includes intra-articular free body, cysts, teres rupture and chondromatosis. The percentage increase 100% due to multiple procedures could have been performed to the same hip.

Table III. Satisfaction with surgery (yes or no) compared between responders and initial non-responders

	Responders	Initial non-responders	P-value
Satisfied with surgery	326 (86%)	73 (70%)	
Not satisfied	53 (14%)	32 (30%)	
			0.0003

Values are presented with *n* (%).

Table IV. Patient-reported outcome measures reported at the 2-year follow-up and change from pre-operatively to the 2-year follow-up for responders and initial non-responders presented as the mean value and SD

HAGOS	Responders	Initial non-responders	P-value	Responders change	Initial non-responders change	P-Value
Symptoms	69.7 (20.7)	69.3 (25.3)	0.87	17.4 (21.3)	17.9 (21.2)	0.77
Pain	75.5 (20.4)	76.0 (25.3)	0.87	19.1 (21.0)	19.8 (22.2)	0.74
Function in daily living	79.3 (21.6)	78.3 (26.5)	0.71	19.5 (22.9)	18.9 (26.0)	0.84
Sports and recreation	64.9 (27.4)	67.0 (30.0)	0.49	23.1 (27.1)	28.7 (28.3)	0.06
Participation in physical activities	58.5 (33.7)	58.7 (34.6)	0.96	30.1 (36.3)	33.8 (35.9)	0.37
Hip and/or groin-related QoL	58.1 (26.4)	59.9 (30.0)	0.59	28.0 (25.5)	29.8 (27.8)	0.54
iHOT-12	66.6 (25.1)	68.0 (26.6)	0.61	22.0 (23.4)	24.5 (25.1)	0.36
EQ-5D	0.75(0.24)	0.74 (0.30)	0.54	0.19 (0.31)	0.18 (0.32)	0.72
EQ-VAS	64.3 (18.8)	65.2 (19.9)	0.68	9.7 (19.4)	8.4 (23.6)	0.56
VAS-Hip function	69.5 (21.7)	65.1 (27.0)	0.08	21.7 (25.0)	19.5 (27.2)	0.46

EQ, European quality of life; HAGOS, the Copenhagen Hip and Groin Outcome Score; iHOT, International Hip Outcome Tool; QoL, quality of life; VAS, visual analogue scale.

Table V. Hip sports activity scale now, before the onset of symptoms and in the adolescence for responders and initial non-responders presented with the mean, SD and P-values

	Responders	Initial non-responders	P-value
HSAS present	3.8 (2.1)	4.1 (2.3)	0.19
HSAS before symptoms	5.2 (1.9)	5.8 (2.0)	0.002
HSAS adolescence	5.7 (1.8)	6.2 (1.8)	0.009

HSAS, hip sports activity scale.

evaluating arthroscopic treatment in hips, with similar patient cohorts, could therefore, benefit from the findings in this study.

The INR-group was younger than the R-group (31.5 versus 35.6 years old). The finding of younger INR is consistent with current literature [8, 17, 26]. The age difference between patients responding or not at follow-ups is important to observe in registry studies, since this non-response bias could affect the results. Although several studies have reported that women are more likely to respond to follow-up, this study did not find an association between gender and response [8, 17]. It is noteworthy that there were more males than females in this study, which could possibly explain why no association was found between gender and responding.

There was a significant difference between the two groups in terms of patient satisfaction, where responders were more satisfied with their treatment. Other surveys evaluating non-responders in knee arthroplasty have presented inferior results in the group of non-responders [13, 14]. Yet, Hojmark *et al.* [8] did not find INR to be less satisfied after spine surgery. Nor did Juto *et al.* [15] not find non-responders to be less satisfied when evaluating a fracture registry. However, there is no consistency in the literature if INR are less satisfied than responders in loss-to follow-up studies. Regardless, it is important to consider when reporting on patient satisfaction and future studies are needed to confirm whether the finding that the INR-group in this study was less satisfied with surgery is clinically relevant. However, the PROM related to satisfaction in the questionnaire has not been validated for this patient category. Although the PROM has high face validity, the degree of validity is not known.

The INR-group had a significantly higher level of activity before the onset of symptoms and during adolescence. Interestingly, there were no differences between the two

groups at the follow-up. Although, the difference was small between the two groups both before onset of symptoms and in adolescence and might not be clinically relevant.

To the authors' knowledge, this study is the first reported study on loss to follow-up in hip arthroscopy registries. There are a few similar studies in orthopaedics comparing responders with non-responders [8, 15, 17, 19]. The Swedish fracture registry found similar outcomes in terms of function between responders and INR with no difference between the groups [15]. In addition, a study from the Danish spine surgery registry concluded that loss to follow-up would not bias the results [8]. The majority of the studies reported no difference of the clinical results between responders and INR. However, a study comparing responders with INR in knee arthroplasty found a poorer outcome for non-responders in function-related scales (American Knee Society score function, Western Ontario McMaster University Osteoarthritis scale function, Short-Form 36 physical and functional scores), yet there were no differences in the pain-related scales [14]. Reinholdsson *et al.* [17] performed a non-response analysis 2 years after undergoing surgery for anterior cruciate ligament and found no difference in EQ-5D between responders and non-responders and the Knee injury and osteoarthritis outcome score only differed on two items (pain and quality of life). However, these are studies evaluating other orthopaedic surgeries and are not completely comparable with the present study. Nevertheless, the results in the present study indicate that loss to follow-up may not bias the conclusions from studies evaluating hip arthroscopy. Data from the registry in this study can, therefore, be considered valid and conclusions drawn from studies performed from the registry are trustworthy. More importantly, this is an essential finding since similar studies evaluating hip arthroscopy could benefit from the conclusion that there is little effect of non-responders.

The overall response-rate in this study was 94%, including both the R- and the INR-group, which exceeds what is commonly accepted [11]. A high response rate is desirable and a study with a large loss to follow-up will reduce the reliability of the study. The debate on response rate in survey and registry studies is continuing and recent studies have questioned the strive for high response rates [11, 15]. An increase in costs and the time-consuming objective of obtaining a high response rate have resulted in discussion of whether a threshold of 60–80% is crucial in order to reduce bias [11]. Even though the results in this current study indicate no difference in PROMs from loss to follow-up, striving for a high response rate is recommended until new guidelines are determined. Previous studies have discussed how loss to follow-up can be

reduced, for example, with telephone reminders or complementary surveys [7, 19]. As seen in this study, a telephone call and several reminding emails increased the response rate to 94%.

There was a high prevalence of bilateral surgeries in both groups in this study compared with the literature, where Klingenstein *et al.* [27] have reported a prevalence of 20%. However, previous studies have shown similar outcomes in simultaneously bilateral hip arthroscopic surgeries compared with unilateral surgeries [28, 29]. The similar outcomes of bilateral and unilateral hip arthroscopies suggest that the results in this study should not be affected by the relatively large percentages of bilateral surgeries.

The indications for hip arthroscopy have increased during the last years, yet femoroacetabular impingement syndrome (FAIS) remains the most common cause of surgery [30]. In this study, surgical procedures are reported, with the majority being cam, pincer or a combination of both. The study has included all hip arthroscopies although there are a limited number of other procedures than FAIS (Table III). The results from this study might, therefore, better mirror a population of FAIS rather than overall hip arthroscopy.

A limitation to the study is that 33 (6%) of the patients in the non-responders (NR) group did not complete the 2-year follow-up. It would have been of interest to include the demographic data of this patient group as well, however, these patients declined participation and could not be included further. Nevertheless, comparing the results between responders to surveys with late responders is a common and acceptable method to estimate the non-responder bias in a study [7]. Another limitation is the possible bias of how the reminding telephone contact could have affected how the patients responded to the questionnaires. This was tried to be reduced by letting the patients answer the PROMs online and not by telephone. A further limitation is the variety in follow-up lengths. The R-group answered at the follow-up 2 years after surgery (mean length of 24.7 months) while the INR-group responded after reminders (mean length of 42.5 months after surgery). This length in follow-up is a major limitation, however, the time set was decided to decrease this period as much as possible. To reach a minimum of 2-year follow-up period the patients had to have undergone surgery in 2016 at its latest. Previous studies have shown that while improvements can be seen already six months after hip arthroscopic surgery, improvements may continue for at least 2 years, supporting a 2-year follow-up as the suitable period for evaluating surgical outcomes after hip arthroscopy [31]. Furthermore, studies have shown similar

outcomes in cohorts at 2 and 5 years after surgery supporting that even though the difference in follow-up between the two groups is large it does not have to affect the results [24, 32]. Patients undergoing re-operation including receiving a THA during the follow-up period were excluded from the study. This could be a possible bias as this group theoretically could have inferior PROMs compared with patients who had not had a re-operation. However, these patients were excluded to receive a more homogeneous study group. Not all PROMs were completed by all patients generating a somewhat inconsistent group size in the different analyses.

CONCLUSION

There were no differences between responders and INR at the follow-up across the PROMs except one in a hip arthroscopy registry. The groups differed in terms of one item, patient satisfaction, where responders were more satisfied than INR.

CONFLICT OF INTEREST STATEMENT

None declared.

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