

Symptom-to-surgery delay before arthroscopic rotator cuff repair for degenerative tears: a retrospective matched gender-based analysis from the La Tour Group

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Background: Degenerative rotator cuff tears are common and can substantially impair quality of life. When conservative management fails, surgical repair is often indicated, and prolonged delays before arthroscopic rotator cuff repair (ARCR) have been associated with tendon degeneration and poorer postoperative outcomes. Although disparities in healthcare access related to gender have been described in other fields, little is known about their influence on surgical timing in rotator cuff disease.

Purpose: This study aimed to determine whether the patient-reported delay between the onset of symptoms and surgery differs between men and women undergoing ARCR for degenerative tears.

Hypothesis: The hypothesis was that no such differences would be observed.

Methods: We conducted a monocentric retrospective matched cohort study of 492 patients (246 men and 246 women) who underwent ARCR for degenerative tears between 2014 and 2025. Patients were matched 1:1 using propensity scores based on age at surgery, preoperative Constant score, Patte classification, and lesion type. The primary outcome was symptom-to-surgery delay. Univariable paired comparisons and multivariable linear regression on log-transformed delay, adjusted for demographics, comorbidities, and preoperative clinical and functional status, were performed. Exponentiated regression coefficients were reported as time ratios, representing multiplicative effects on delay.

Results: The mean delay was 27±40 months for men and 24±29 months for women (mean difference: 3 months; 95%CI: -3 to 9; $p=0.291$). In the multivariable model, women experienced a delay that was estimated to be 15% shorter than men's (95% CI: -42% to +10%; $p=0.224$).

Conclusion: In this cohort, we found no evidence of gender-related differences in the delay between symptom onset and ARCR for degenerative rotator cuff tears.

What is already known on this topic: Delays before arthroscopic rotator cuff repair (ARCR) can worsen tendon quality and outcomes, but the impact of gender on surgical timing remains unclear.

What this study adds: This matched cohort study found no significant difference in symptom-to-surgery delay between men and women undergoing ARCR for degenerative tears.

How this study might affect research, practice or policy: These results suggest equitable surgical access across genders in this context, supporting standardized criteria and highlighting the need to explore other factors influencing delay.

Study design: Retrospective matched cohort study comparing men and women.

Level of evidence: Level III; Quality Improvement Study

Keywords: Shoulder; Tendon tear; Female; Equity; Fairness; Privileged and underrepresented groups.

<https://doi.org/10.70885/hmsj.2026.04.001>

Introduction

Advances in arthroscopic techniques have made arthroscopic rotator cuff repair (ARCR) the preferred method for treating RCTs [1][2][3]. ARCR significantly improves health-related quality of life, pain and mental well-being [4]. Various factors, including age, tendon involvement, and time to surgery, have been investigated for their impact on ARCR outcomes. Delay before surgery is important as it has been associated with adverse factors, such as fatty infiltration or reduced tendon quality. These factors can impair postoperative patient-reported outcomes, as well as range of motion, and increase re-tear and revision rates [5][6][7][8]. Therefore, understanding what influences the timing of surgery is therefore essential for optimizing outcomes in patients undergoing ARCR for atraumatic tears. However, most evidence regarding surgical delay originates from traumatic tears, for which surgery is typically recommended immediately [9][10], leaving little opportunity for delay to affect outcomes. In contrast, studies examining degenerative tears have reported inconsistent findings [4][11][12].

In recent years, increasing attention has been given to gender as a critical factor in biomedical research in order to better understand disparities between men and women [13][14]. For example, a recent cardiovascular study in Switzerland has demonstrated gender-based differences in diagnostic pathways and therapeutic decisions [15]. Given the impact of gender on healthcare access and treatment outcomes, it is plausible that similar differences could exist in the timing of surgical care for degenerative shoulder conditions. However, although extensive research has examined surgical techniques, implants, and comorbidities in ARCR, the potential influence of gender has received far less attention [16][17].

This study aims to address this gap by determining whether gender-based differences exist in the delay from symptom onset to surgery among patients undergoing ARCR for degenerative tears. Our hypothesis was that no such differences would be observed.

Methods and Materials

Study design and population

This monocentric retrospective comparative matched cohort study was conducted on a consecutive series of patients who underwent ARCR following atraumatic tears. All data were collected prospectively by a single senior surgeon (AL) between January 2014 and February 2025 at La Tour Hospital in Geneva, Switzerland. Patients were included if they met the following criteria: (i) age over 18 years, (ii) confirmed rotator cuff tear via clinical history, physical

examination and imaging, (iii) had a reparable lesion, (iv) exhibited fatty infiltration graded 0, 1 or 2 according to the Goutallier classification [18], (v) underwent ARCR, and (vi) provided written informed consent for the use of health-related data for research purposes. Patients were excluded if they (i) withdrew their written informed consent for the use of health-related data for research purposes or (ii) had missing or incomplete data on the symptom-to-surgery delay. To reduce potential confounding factors, patients were matched according to propensity scores estimated using a logistic regression model that included (i) age, (ii) preoperative Constant score, (iii) Patte classification [19] and (iv) type of lesion [20]. These variables were selected because they are known to influence both symptom severity and functional impairment, which may affect care-seeking behavior and timing of surgical referral [21].

Ethics approval and patient consent

This study was conducted in accordance with the Declaration of Helsinki and an a priori approval of our local ethics committee was obtained (CCER 2020-02670). This manuscript adheres to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement guidelines [22] (**Supplementary material 1**). Every patient provided a written informed consent for the use of their data.

Equity, Diversity, and Inclusion

The studied population included women and men originating from various countries in Southern Africa, North America, Oceania and Europe in a usual proportion for such pathology. Furthermore, the cohort included a range of ages with different backgrounds and demographics.

Our research team included a woman and three men at various stages in their career and clinical disciplines, originating from central Europe. We do not present data on race, socioeconomic status or other social determinants.

Study variables

The dependent variable and primary outcome of this study was the symptom-to-surgery delay. The main independent variable of interest was gender, recorded as a self-reported choice (man, woman, or other). Symptom onset was defined as the first occurrence of shoulder pain or functional limitation as reported by the patient, regardless of healthcare consultation or imaging confirmation. Additional collected variables included age, body mass index (BMI), dominant arm operated on, presence of hypertension, hypercholesterolemia, and psychosocial disorders; workers' compensation and smoking statuses; number of preoperative infiltrations, type lesion, Patte classification, and several preoperative clinical measures such as range of motion (anterior elevation,

external rotation, and internal rotation), and patient-reported outcome measures (PROMs), including pain on the visual analog scale (VAS pain), the Constant score, the American Shoulder and Elbow Surgeons (ASES) score, and the Subjective Shoulder value (SSV) score.

Symptom-to-surgery delay and PROMs were collected from patient self-reports during preoperative consultations. Patients used tablets equipped with the Follow Health software to complete the case report form while waiting in the reception area. An independent evaluator conducted range of motion measurements under the supervision of the senior author (A.L.). Active forward flexion and external rotation at 0 degrees of abduction were assessed with a goniometer while the patient being in an upright position. Internal rotation behind the back was estimated to the nearest spinal level and noted on a 20-level scale ranging from 0 points (thigh) to 19 points (T1 thoracic spine).

Sample size calculation

Guevara-Alvarez et al. [23] reported an average symptom-to-surgery delay of 23.4 ± 25.8 months for atraumatic cuff tears. Based on the clinical experience of our senior surgeon and the commonly defined thresholds in the literature [8], we estimated that the minimal clinically important difference (MCID) for symptom duration before an ARCR to be six months. A priori sample size calculation conducted in G*Power indicated that 148 patients would be needed to detect this MCID, using a two-sided α level of 0.05 and a statistical power of 0.80. Descriptive statistics were reported for continuous variables as mean $\pm$ standard deviation, and for qualitative variables as absolute and relative frequencies. Shapiro–Wilk tests and Q-Q plots were used to assess normality.

Statistical Analysis

Patients were matched in a 1:1 ratio using nearest-neighbor matching without replacement, and a caliper width of 0.2 standard deviations of the logit of the propensity score. The covariate balance after matching was assessed using standardized mean differences, with all covariates achieving a standardized mean difference below 0.1. As this was a matched study, paired tests were used for both between-group comparisons (women vs. men) and within-group (pre- and post-intervention) comparisons. Continuous variables were compared using the paired Student's t-test or the Wilcoxon signed-rank tests, and categorical data were

compared using McNemar's test or the Bowker test if there were more than two categories. The statistical analysis also included a mixed-effects regression model in which the dependent variable was symptom-to-surgery delay, and the main independent variable of interest was gender. To prevent overfitting, we followed the rule of ten patients per predictor. The dependent variable was log-transformed to meet model assumptions, as the symptom-to-surgery delay variable was expected to have a log-normal distribution rather than a normal one. Regression coefficients were exponentiated and are reported as ratios of geometric means, representing multiplicative effects on symptom-to-surgery delay. Assumptions checked before modeling included log-linearity of continuous variables, homoscedasticity of residuals, and normality of residual distributions. The model was adjusted for relevant covariates, including age, BMI, dominant arm operated, hypertension, hypercholesterolemia, psychosocial disorders, worker's compensation status, smoking status, number of preoperative injections, Patte classification, and preoperative clinical condition comprising range of motion (anterior elevation, external rotation and internal rotation), VAS pain and the Constant and SSV scores. Statistical analyses were performed using R version 4.4.2 (R Foundation for Statistical Computing, Vienna, Austria). P-values < 0.05 were considered statistically significant.

Results

Of the 581 patients initially included, 13 (2%) were excluded due to missing data on the primary outcome ($n=3$) or matching variables ($n=10$). Of the remaining 568 patients, 492 were matched into two equivalent groups of 246 men and women (**Figure 1 and 2**).

The final cohort had a mean age of 57 ± 9 years old (men 57 ± 10 vs. women 57 ± 8 , $p=0.541$) and comparable demographic and lesion characteristics. However, there were differences in BMI (men 27 ± 4 vs. women 25 ± 4 , $p<0.001$) and hypercholesterolemia (men 18% vs. women 10%, $p=0.005$). Regarding the functional baseline status, forward flexion was comparable between genders (men 149 ± 32 vs. women 149 ± 28 , $p=0.982$). However, women had higher external rotation at side (42 ± 18 vs. 47 ± 19 , $p=0.002$) but lower VAS pain (55 ± 18 vs. 62 ± 18 , $p<0.001$), ASES (52 ± 18 vs. 48 ± 17 , $p=0.001$) and SSV (49 ± 20 vs. 44 ± 20 , $p=0.004$) scores, although these differences did not reach clinical relevance (**Table 1**).

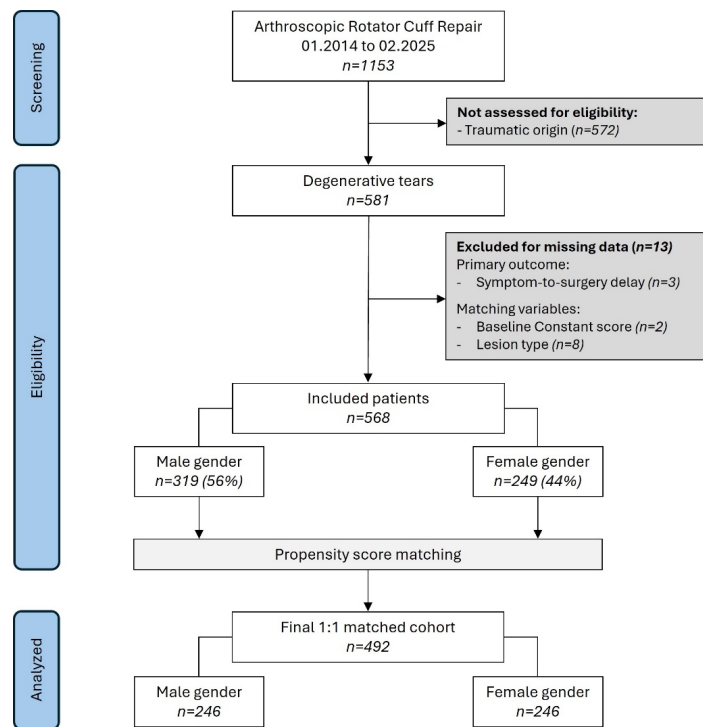


Figure 1. Flow diagram.

Distribution of Propensity Scores

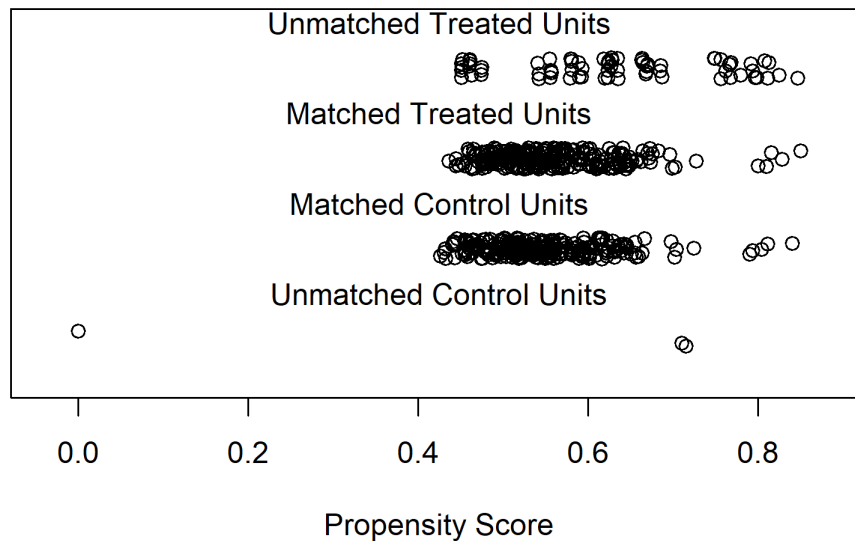


Figure 2. Distribution of propensity scores between men (treated units) and women (control units).

Table 1: Baseline demographic, clinical, and lesion characteristics of the study population

	Included patients (n=568)					Matched cohort (n=492)				
	Men (n=319)		Women (n=249)			Men (n=246)		Women (n=246)		
	Mean	±SD	Mean	±SD		Mean	±SD	Mean	±SD	
	n	(%)	n	(%)	p-value	n	(%)	n	(%)	p-value
Age at surgery, years	57	±10	57	±8	0.406	57	±10	57	±8	0.541
Height, cm	176	±7	164	±7	<.001	176	±7	164	±7	<.001
BMI, kg/m ²	27	±4	25	±4	<.001	27	±4	25	±4	<.001
Dominant arm	225	(70%)	174	(70%)	0.974	173	(70%)	172	(70%)	0.976
Hypertension	42	(15%)	40	(20%)	0.173	31	(15%)	40	(21%)	0.298
Hypercholesterolemia	50	(18%)	19	(10%)	0.017	37	(18%)	19	(10%)	0.005
Diabetes	63	(23%)	51	(26%)	>.999	47	(22%)	51	(26%)	>.999
Smoker	84	(30%)	28	(15%)	0.226	63	(30%)	28	(15%)	0.457
Psychological disorder	20	(9%)	26	(17%)	0.034	14	(8%)	26	(17%)	0.424
Working compensation	82	(26%)	61	(25%)	0.882	60	(24%)	60	(25%)	>.999
Lesion type					0.089					0.894
A	42	(13%)	31	(12%)		36	(15%)	31	(13%)	
B	12	(4%)	7	(2%)		6	(2%)	5	(2%)	
C	44	(14%)	42	(17%)		39	(16%)	42	(17%)	
D	94	(29%)	61	(24%)		68	(25%)	61	(25%)	
E	3	(1%)	2	(1%)		2	(1%)	2	(1%)	
SS	101	(32%)	100	(40%)		90	(37%)	100	(41%)	
SSc	23	(7%)	6	(2%)		5	(2%)	5	(2%)	
Patte classification					0.085					0.213
1. Close to insertion	171	(54%)	143	(57%)		133	(54%)	142	(58%)	
2. Level of humeral head	97	(30%)	82	(33%)		78	(32%)	81	(33%)	
3. Level of glenoid	51	(16%)	24	(10%)		35	(14%)	23	(9%)	
N of pre-operative infiltrations					0.116					0.201
0	211	(66%)	155	(63%)		162	(66%)	154	(63%)	
1	53	(17%)	37	(15%)		42	(17%)	37	(15%)	
2	32	(10%)	23	(9%)		23	(9%)	22	(9%)	
≥3	22	(7%)	32	(13%)		18	(7%)	31	(13%)	
Functional pre-operative status										
Forward flexion, °	149	±31	149	±28	0.955	149	±32	149	±28	0.982
External rotation at side, °	40	±18	47	±19	<.001	42	±18	47	±19	0.002
Internal rotation at side, level										0.001

Back pocket	22	(7%)	29	(12%)		12	(5%)	29	(12%)	
Lower back	80	(25%)	40	(16%)		63	(26%)	40	(16%)	
Middle of the back	139	(44%)	94	(38%)		103	(41%)	92	(37%)	
Upper back	78	(24%)	86	(34%)		68	(28%)	85	(35%)	
VAS pain, 0 to 100 (worst)	55	±18	61	±18	<.001	55	±18	62	±18	<.001
ASES, 0 to 100 (better)	52	±18	48	±17	0.005	52	±18	48	±17	0.001
Constant score, 0 to 100 (better)	51	±19	49	±19	0.118	52	±18	49	±18	0.077
SSV score, 0 to 100 (better)	49	±21	44	±20	0.004	49	±20	44	±20	0.004

ASES, American Shoulder and Elbow Surgeons Shoulder score; BMI, Body Mass Index; N, Number of patients; SD, Standard deviation; SSV, Subjective Shoulder Value; VAS, Visual Analog Scale. Lesion type classification: A, Supraspinatus and superior subscapularis tears; B, Supraspinatus and entire subscapularis tears; C, Supraspinatus, superior subscapularis, and infraspinatus tears; D, Supraspinatus and infraspinatus tears; E, supraspinatus, infraspinatus, and teres minor tears; SS, Supraspinatus tears; SSc, Subscapularis tears

The mean symptom-to-surgery delay was 27±40 months (median [interquartile range (IQR)], 16 [8 to 28]) for men and 24±29 months (median [IQR], 14 [7 to 27]) for women. The univariable comparison showed no statistically significant difference between men and women (mean difference of 3

[-3 to 9] months, $p = 0.291$). Approximately two-thirds, had a symptom-to-surgery delay longer than a year, and the distribution of the delay was comparable between genders ($p = 0.650$, **Table 2**).

Table 2: Comparison of symptom-to-surgery delay between men and women

	Men(n=246)		Women (n=246)		p-value
	n	(%)	n	(%)	
Symptom-to-surgery delay					0.650
<6 months	25	(10%)	20	(8%)	
6-12 months	60	(24%)	70	(29%)	
12-24 months	65	(27%)	70	(29%)	
>24 months	96	(39%)	86	(34%)	

In the multiple linear regression adjusted for comorbidities, demographics, and preoperative clinical and functional status, gender was not significantly associated with symptom-to-surgery delay. Female gender was associated with a shorter delay compared with male sex (time ratio 0.85; 95% CI, 0.66–1.10), corresponding to a 15% reduction in delay, although this difference did not reach statistical significance ($p = 0.224$).

Discussion

This study aimed to investigate whether gender-based differences exist in the delay from symptom onset to surgery among patients undergoing ARCR for degenerative tears. We

found no significant difference between men and women, confirming our hypothesis. However, the confidence intervals encompassed clinically meaningful differences, indicating that smaller gender-related differences in symptom-to-surgery delay cannot be definitively excluded.

Univariable analysis showed a mean delay of 27±40 months for men and 24±29 months for women (mean difference of 3 months; 95%CI: -3 to 9; $p=0.291$). Multivariable regression analysis, adjusted for demographic, clinical, functional, and comorbidity-related covariates, similarly showed no significant association between gender and delay (time ratio 0.85 for women; 95% CI: 0.66–1.10; $p=0.224$). These findings suggest no evidence of gender-related disparities in access to surgical care for degenerative rotator cuff tears, although

the confidence interval of the univariable comparison encompassed the clinically relevant threshold of six months, indicating that smaller but potentially meaningful differences cannot be excluded.

Timing of surgical intervention is clinically relevant because prolonged delays have been associated with tendon retraction, fatty infiltration, and structural deterioration, which can compromise repair and postoperative outcomes [24][25]. While these associations are well-established for traumatic tears, the literature for degenerative tears is more heterogeneous [4][11][12]. Despite the increasing recognition of gender as a determinant of healthcare access and outcomes in various medical fields, few studies have investigated its influence on surgical timing in rotator cuff disease [17].

Differences in preoperative symptom severity or functional status may affect the timing of initial consultation, as patients with more severe pain or disability may seek care earlier. Several studies have reported that women often present with worse pain and reduced function preoperatively [26][27][28][29]. Daniels et al. found that, although these differences dissipated by one year, women experienced greater pain and reduced function before and shortly after ARCR [30]. Similarly, Razmjou et al. similarly observed higher levels of pre- and postoperative disability in women [31]. In contrast, a recent reported delayed care in women [32], but this analysis was unadjusted and may reflect confounding factors, such as differences in preoperative disease burden, expectations, or occupational demands [26].

Gender-based disparities may also arise during the consultation-to-surgery interval. A large registry-based study conducted in the United States has documented sex-based differences in surgical utilization and perioperative outcomes, suggesting that disparities can occur in rotator cuff care [29]. Similarly, Swiss studies in other medical fields, such as cardiovascular medicine [15] and total joint replacement [33], have reported differences in referral patterns, access to imaging, and specialist care. Despite Switzerland's high-quality universal coverage, such disparities highlight systemic differences that could extend to other fields. In our institution, the absence of significant gender differences in delay may reflect the strengths of the Swiss healthcare system, which comprises universal insurance, standardized diagnostic protocols, and objective surgical criteria that help minimize potential bias. Treatment decisions, including referral for surgery, are largely based on standardized protocols considering tendon reparability, functional impairment, and response to nonoperative management, which reduces subjective influence.

This study has several strengths. It has a relatively large cohort with prospectively collected data from a single surgeon, ensuring consistency in surgical indications and techniques. Propensity score matching enhanced comparability between genders for age, lesion type, tendon retraction, and preoperative Constant score, all known to influence both care-seeking behavior and surgical outcomes. Social or cultural factors, such as fear of surgery, time off work, or domestic duties, may influence delay in some settings [26], but likely have less impact in contexts with equitable access, as highlighted by Kurkowski et. al. [32].

Nevertheless, some limitations should be acknowledged. First, symptom duration was self-reported, which introduces the risk of recall bias. Additionally, this was a single-center study conducted in Switzerland, so the findings may not be generalizable to healthcare systems with different structures, referral processes, or socioeconomic barriers. Furthermore, our analysis was limited to the overall delay between symptom onset and surgery. Therefore, we lacked the granularity to examine the different stages of the patient pathway, such as the time from symptom onset to first consultation, from consultation to diagnosis, and from diagnosis to surgery. Future studies should collect stage-specific timing data to identify where potential disparities may arise and inform targeted interventions. Finally, we did not examine postoperative outcomes, which limits our ability to explore whether gender-based differences emerge after surgery despite comparable access.

Conclusion

This study found no evidence of a gender-based difference in symptom-to-surgery delay among patients undergoing ARCR for degenerative tears.

Open access statement

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Funding

No funding influenced the investigation.

Conflict of interest statement

AL is a paid consultant for Stryker, Medacta, and Arthrex. He receives royalties from Stryker. He is the founder of FORE, BeeMed, and Med4Cast. He owns stock options of Medacta,

BeeMed, and FollowHealth. The other authors declare that they have no competing interests.

Author's contributions

Liani Devaux: Data analysis, Data interpretation, writing article. Anthony Pernoud: Study design, Data interpretation, supervision, statistics, illustrations, writing article. Hugo Bothorel: Study design, supervision, reviewing article. Alexandre Lädermann: Data acquisition, Study design, supervision, reviewing article.

L. Devaux and A. Pernoud equally contributed to this work (co-first authorship).

Acknowledgments

The authors thank the LaTour (Leading Advancements in Therapeutic and Outcome-based Research) group for their support.

Abbreviations

ARCR: *Arthroscopic Rotator Cuff Repair*

ASES: *American Shoulder and Elbow Surgeons*

BMI: *Body Mass Index*

CCER: *Cantonal Commission on Ethics in Human Research*

95%CI: 95% Confidence interval

MCID: *Minimal Clinically Important Difference*

PROM: *Patient reported outcome measure*

RCTs: *Rotator Cuff Tears*

SSV: *Subjective Shoulder Value*

STROBE: *STrengthening the Reporting of OBservational studies in Epidemiology*

VAS: *Visual Analogue Scale*

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