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Anterior cruciate ligament reconstruction in the over-50s. A prospective comparative study between surgical and functional treatment

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ABSTRACT

Introduction: In patients aged over-50 years, although data are sparse, results of anterior cruciate ligament (ACL) surgery are good if selection is correctly performed. However, non-operative treatment is usually proposed for this age group, as patients generally prefer just to scale down their sports activities. Non-operative results are acceptable, but with a high risk of residual instability, secondary lesions and lifestyle alteration. The main aim of the present study was to compare results between surgical versus non-surgical treatment of ACL tear in over-50 year-olds. Secondary objectives comprised assessing prognostic factors for poor functional outcome, and comparing the 2 groups epidemiologically to identify clinical decision-making factors. The study hypothesis was that results are comparable between operative and non-operative treatment of ACL tear.

Material and method: Three hundred twenty patients were followed up prospectively: 92 non-surgical (NS group) and 288 surgical (S group). Classical epidemiological data were collected. Clinical laxity, differential laximetry, KOOS, IKDC, Tegner and ACL-RSI scores and radiologic assessment were collected pre- and postoperatively, as were intraoperative data. Early and late complications were collected.

Results: All patients were followed up. Patients were principally female, and were older, less athletic, with more stable knee and less severe functional impact in the NS group. Functional scores improved in both groups, and especially in group S, where sports scores were also better. In the NS group, laximetry at follow-up correlated with preoperative marked pivot-shift ($p=0.024$). Severe differential laxity was predictive of poor IKDC score ($p=0.06$). In the S group, laximetry at follow-up correlated with preoperative explosive pivot-shift ($p<0.001$), lateral meniscal lesion ($p=0.007$), use of hamstring tendon ($p=0.007$), and non-operated early complications ($p=0.004$). Factors for poor global KOOS score in group S comprised female gender ($p<0.001$), high BMI ($p<0.001$) and skiing ($p=0.038$). Factors for poor Tegner scores comprised skiing or team sport ($p<0.05$), isolated moderate medial osteoarthritis ($p=0.01$), and non-operated early complications ($p=0.022$). Factors for poor IKDC score comprised female gender ($p=0.064$), and non-operated early complications ($p=0.019$). Complications did not differ between groups.

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Discussion/Conclusion: Results were satisfactory in both groups, with significant improvement in functional scores, but were better in group S. For NS patients, pivot sport was barely feasible and sports activity scores decreased. In case of severe laxity at diagnosis, surgical treatment should be proposed.
Level of evidence: III; non-randomized prospective comparative series.

1. Introduction

Anterior cruciate ligament (ACL) tear is frequent, with around 100,000 cases per year in France. In young patients, surgical reconstruction is usually proposed, and gives very satisfactory results [1]. For patients over-50 years of age, data are sparse, with 264 cases in 9 publications between 2003 and 2017 [2–10]. The pathology is rare: according to the Swedish registry, the rate of ACL tear in over-50 year-olds is around 20/100,000 per year [11]. Results of surgery are still good, especially if correct selection is implemented in terms of motivation and sports level [2–10]. However, non-operative treatment is widely proposed, as patients tend to prefer to scale down their sports activity rather than undergo surgery. The literature on progression after non-operative treatment is even more sparse; results are acceptable but with a high risk of residual instability, secondary lesions and need to alter lifestyle [12–16].

The main aim of the present multicenter prospective study, launched by the 2018 French Arthroscopy Society (SFA) symposium [17–19], was to compare results between surgical and non-surgical treatment of ACL tear in over-50 year-olds. Secondary objectives comprised:

- to screen for prognostic factors of poor outcome, and;
- to compare the 2 groups epidemiologically to identify clinical decision-making factors.

The study hypothesis was that results are comparable between operative and non-operative treatment of ACL tear.

2. Material and method

2.1. Study design

A prospective comparative study was conducted in 10 centers (5 private hospitals, 5 university hospitals) between January 1, 2016 and June 1, 2018. Data for all patients aged over-50 years with ACL tear managed operatively or non-operatively were collected. Exclusion criteria comprised multi-ligament involvement and history of contralateral surgery other than simple arthroscopy. The study had local data protection committee approval (ID n° RCB 2016-A01140-51) and national data protection commission (CNIL) approval. Choice of operative/non-operative treatment was at the surgeon's discretion, in agreement with the patient.

2.2. Method

Classical causal factors were collected: age at trauma, body-mass index (BMI), accident-to-surgery time, sports activity (none, team sport, skiing, other) and level (professional, competition, leisure), and sedentary or active lifestyle.

Data collected preoperatively and at last follow-up comprised: effusion (none, slight, moderate, severe), extension deficit (<3°, 3–5°, 6–10°, >10°), flexion deficit (0–5°, 6–15°, 16–25°, >25°), Lachman test (hard, soft), pivot-shift test (identical to contralateral, slight, marked, explosive), medial or lateral femorotibial osteoarthritis or patellofemoral osteoarthritis (none, mild,

moderate (<50% narrowing or joint space 2–4 mm), severe (>50° narrowing or joint space <2 mm)), IKDC score, differential instrumental laximetry, and Tegner, KOOS and ACL-RSI (Return to Sports after Injury) (max., 100%) scores.

Data collected intraoperatively comprised: anterolateral reconstruction, type of graft (hamstring, extensor (quadriceps tendon or patellar ligament)), type of fixation (cortical, press-fit, DTC screw), medial lesion (none, medial, lateral, bicompartamental), meniscal treatment (none, sparing, resection, suture), and chondral lesions (none, medial, lateral, patellar multicompartamental).

Data collected at last follow-up comprised time to return to sport.

Early (<3 months) and late (>3 months) postoperative complications were collected.

2.3. Series

The series comprised 320 patients (92 non-surgical (NS), 228 surgical (S)) (Table 1). Preoperatively, the NS group was older ($p < 0.001$), less athletic ($p = 0.008$) and flexion was poorer ($p = 0.024$). Laxity was greater in the S group (soft Lachman test, $p < 0.001$; marked pivot-shift, $p < 0.001$; differential laximetry, $p < 0.001$), and functional impact on KOOS was greater ($p < 0.001$). There was less patellofemoral osteoarthritis in the S group ($p = 0.006$).

Table 2 shows intraoperative data.

2.4. Statistics

Normal distribution was checked on Shapiro-Wilk test. For non-normally distributed quantitative variables, intergroup differences were assessed on Wilcoxon rank sum or Mann-Whitney U test and Kruskal-Wallis test. Matched pre- and postoperative paired values were compared on t test. Intergroup correlations were assessed on Pearson test. For non-normally distributed qualitative variables, intergroup differences were assessed on Fisher exact and χ^2 test. Multivariate linear regression was used to determine associations between 5 results and >15 independent variables: continuous variables (global KOOS score, differential laxity, Tegner score, time to return to sport); binomial variables (return to sport yes/no, IKDC dichotomized as A&B vs C&D); independent continuous variables (age, BMI, accident-to-surgery time, preoperative differential laxity); independent qualitative variables (gender, type of sport, work accident, preoperative IKDC, preoperative rotational pivot-shift, medial osteoarthritis, medial or lateral meniscal lesion, type of graft, femoral fixation, early complications).

Analyses used R software, version 3.3.2 (R Foundation for Statistical Computing, Vienna, Austria). The significance threshold was set at $p < 0.05$.

3. Results

All patients were followed up, for a mean 14.2 ± 3.8 months (range, 3.5–30.5 months) in group S and 18 months in group NS (Table 3).

Table 1
Preoperative data.

Parameters	Non-surgical, n (%) = 92 cases	Surgical (%) = 228 cases	p
Age at surgery	59.9 ± 6.6 (50.8–74.2)	54.8 ± 4.3 (50–71.6)	p < 0.001
Gender			
Male	35 (38%)	94 (41%)	
Female	57 (62%)	134 (59%)	
BMI (kg/cm ²)	24 ± 3.7 (18.2–35.5)	24 ± 3.6 (16.5–36.1)	
Accident-to-surgery time (days)		23.6 ± 59 (0.3–414)	
Work accident			
Yes	86 (93%)	214 (94%)	
No	6 (7%)	14 (6%)	
Sport			p = 0.008
None	15 (16%)	22 (10%)	
Team	3 (3%)	14 (6%)	
Skiing	50 (54%)	117 (51%)	
Other	24 (26%)	75 (33%)	
Sports level			
Professional/competition sport	1 (1%)	18 (8%)	
Leisure sport	59 (64%)	159 (70%)	
Active	27 (29%)	33 (14%)	
Sedentary	5 (5%)	18 (8%)	
Effusion			
None	35 (38%)	110 (48%)	
Trace	41 (45%)	77 (34%)	
Moderate	12 (13%)	31 (14%)	
Severe	4 (4%)	10 (4%)	
Extension deficit			
<3°	69 (75%)	187 (82%)	
3–5°	19 (21%)	32 (14%)	
6–10°	2 (2%)	5 (2%)	
>10°	2 (2%)	4 (2%)	
Flexion deficit			p = 0.024
0–5°	49 (53%)	161 (71%)	
6–15°	23 (25%)	36 (16%)	
16–25°	11 (12%)	14 (6%)	
>25°	9 (10%)	17 (7%)	
Lachman test			p < 0.001
Hard	30 (33%)	11 (5%)	
Soft	62 (67%)	217 (95%)	
Pivot-shift test			p < 0.001
=contralateral	22 (24%)	16 (7%)	
Slight	36 (39%)	51 (22%)	
Marked	26 (28%)	135 (59%)	
Explosive	2 (2%)	18 (8%)	
Not measurable	6 (7%)	8 (4%)	
Medial osteoarthritis			
None	81 (88%)	178 (78%)	
Mild	8 (9%)	37 (16%)	
Moderate	2 (2%)	13 (6%)	
Severe			
Not known	1 (1%)		
Lateral osteoarthritis			
None	86 (93%)	216 (95%)	
Mild	4 (4%)	9 (4%)	
Moderate	1 (1%)	3 (1%)	
Severe			
Not known	1 (1%)		
Patellofemoral osteoarthritis			p = 0.006
None	71 (77%)	206 (90%)	
Mild	19 (21%)	18 (8%)	
Moderate	1 (1%)	4 (2%)	
Severe			
Not known	1 (1%)		
IKDC			
A			
B	10 (11%)	11 (5%)	
C	46 (50%)	109 (48%)	
D	34 (37%)	102 (45%)	
Not known	2 (2%)	6 (3%)	
Differential laxity	4.5 ± 2.8 (0–13)	6.5 ± 3.4 (–2–17.5)	p < 0.001
Tegner score (100%)	5.1 ± 1.3 (3–9)	5.2 ± 1.5 (2–9)	
KOOS symptoms (0–100)	67.3 ± 13.4 (21–100)	62.5 ± 19.8 (0–100)	p = 0.014
KOOS pain (0–100)	69.3 ± 15.2 (25–100)	61.3 ± 19.9 (6–100)	p < 0.001
KOOS daily living (0–100)	80 ± 15.1 (25–100)	66.9 ± 21.5 (0–100)	p < 0.001
KOOS sport (0–100)	42.7 ± 24.9 (0–80)	34.3 ± 21 (0–100)	p = 0.006
KOOS quality of life (0–100)	49.1 ± 20.2 (0–81.3)	34.5 ± 21 (0–92)	p < 0.001
KOOS global (0–100)	68 ± 13.3 (22–92.9)	58 ± 17.5 (3.6–91.1)	p < 0.001
ACL-RSI (100%)	30.2 ± 26.1 (0–84.2)	25 ± 20.2 (0–82)	

Table 2
Intraoperative data.

Parameters	n (%) = 228 cases
Anterolateral reconstruction	
Yes	37 (16%)
No	191 (84%)
Graft	
Hamstring	197 (86%)
Extensor system	31 (14%)
Fixation	Femoral Tibial
Cortical	124 (54%) 38 (17%)
Press-fit	17 (7%)
Screw	76 (33%) 179 (79%)
DTC	11 (5%) 11 (5%)
Meniscal lesion	
None	74 (32%)
Medial	83 (36%)
Lateral	25 (11%)
Both	46 (20%)
Meniscal treatment	Medial Latéral
None	99 (43%) 157 (69%)
Left in situ	17 (7%) 29 (13%)
Resected	77 (34%) 24 (11%)
Sutured	25 (11%) 16 (7%)
Sequela of prior resection	10 (4%) 2 (1%)
Chondral lesion	
None	55 (24%)
Medial	30 (13%)
Lateral	4 (2%)
Patellar	17 (7%)
Mixed	122 (54%)

3.1. Clinical results

At follow-up, group S patients showed more stable knee, with more frequent hard Lachman test ($p < 0.001$), less frequent marked pivot-shift ($p < 0.001$) and better differential laxity (2.2 ± 2.4 mm (range, -6 to $+13$ mm), versus 4.2 ± 3.2 mm (range, 0 – 13 mm) in NS; $p < 0.001$), with comparable range of motion. Differential laxity showed significant improvement in group S ($p < 0.001$), and was unchanged in group NS.

IKDC score was better in group S, with 79% grade A or B ($p < 0.001$).

There was no intergroup difference for global KOOS score ($p = 0.412$), while both groups showed significant improvement ($p < 0.001$). The only KOOS subscore showing a significant intergroup difference was quality of life ($p < 0.001$), while both groups again showed significant improvement on all subscores ($p < 0.001$).

Tegner scores showed significant improvement ($p = 0.42$ in S and $p < 0.001$ in NS), while the 2 groups differed significantly at last follow-up ($p < 0.001$).

ACL-RSI scores also showed significant improvement ($p < 0.001$), while the 2 groups differed significantly at last follow-up ($p < 0.001$).

3.2. Radiology results

There was less medial osteoarthritis in group NS ($p = 0.021$) and less patellofemoral osteoarthritis in group S ($p < 0.001$). There was no difference regarding the lateral compartment.

3.3. Complications

Regarding early complications, there were 19 cases of hematoma in group S (8%), managed by surveillance without surgery. There were 6 late complications in group NS (7%) and 33 in group S (14%) (Table 4) without significant difference. There were 2 secondary ligament tears (1%).

3.4. Prognostic factors

In group NS, the degree of differential laxity at follow-up correlated with preoperative marked pivot-shift ($p = 0.024$). Severe preoperative differential laxity was a factor for poor IKDC score ($p = 0.06$).

In group S, the degree of differential laxity at follow-up correlated with preoperative explosive pivot-shift test ($p < 0.001$), lateral medial meniscus lesion ($p = 0.007$), use of hamstring tendon for transplant ($p = 0.007$) and non-operated early complications ($p = 0.004$). Factors for poor global KOOS score comprised female gender ($p < 0.001$), high BMI ($p < 0.001$) and skiing ($p = 0.038$). Factors for poor Tegner score comprised skiing and/or team sport ($p < 0.05$), moderate isolated medial osteoarthritis ($p = 0.01$) and non-operated early complications ($p = 0.022$). Factors for poor IKDC score comprised female gender ($p = 0.064$) and non-operated early complications ($p = 0.019$).

4. Discussion

The main aim of the present study was to compare results between operative and non-operative management of ACL tear in over-50 year-olds, with the hypothesis that results are comparable.

Both groups showed significant improvement in functional scores, thus partially confirming the hypothesis. Global KOOS and ACL-RSI scores were comparable, but the IKDC and Tegner scores and the KOOS quality of life subscore were significantly better in the surgery group, which also showed more stable knee on Lachman and pivot-shift tests and differential laximetry. Thus, whichever the treatment option, results are satisfactory, with no major impact on daily life, although sports activity is hindered and reduced in case of non-operative treatment, and this point needs raising in consultation. It is due to persistent laxity and instability, which is unsurprisingly greater in case of non-operative treatment, although related to preoperative values. The patient's preoperative activity level and motivation are thus more important than mere age, as already stressed elsewhere [4,6].

The literature corroborates the present good results of surgery [2–10], even in exceptional cases associating ACL reconstruction to meniscal allograft [3]. Results in over-50 year-olds are identical to those in younger patients. Osti et al. [6] compared 2 groups of 20 patients (>50 and <30 years of age), and found no significant differences at 2 years. Complications rates in over-50 year-olds are also comparable to those in younger patients, with no greater risk of re-tear [17,20]. In the present series, the re-tear rate was very low, with only 2 cases (1%).

In over-50 year-olds, in the literature type of transplant has no impact on results, whether hamstring [5,9], extensor systema with patellar tendon [2], or allograft [4,9], although in the present study hamstring tendon was associated with poorer results. There is also no difference in results between simple or double-bundle ACL reconstruction [7].

Non-operative management is feasible when sports demand is not high [12–16]. Clinical results are comparable to those in the present study, with more unstable knee ruling out pivot sports. There is a long-term risk of failure and iterative lesion, especially in the meniscus [12,16]. Ciccotti et al. [12] reported 97% soft Lachman test and 67% explosive pivot-shifts. Buss et al. [16] likewise reported 52% failure.

The secondary objectives were:

- to identify prognostic factors for poor functional outcome, and;
- to compare the 2 groups epidemiologically to identify factors relevant to decision-making.

Table 3
Results.

Parameters	Non-surgical, n (%)=92 cases	Surgical (%)=228 cases	p
Effusion			
None	77 (84%)	202 (89%)	
Trace	14 (15%)	17 (7%)	
Moderate	1 (1%)	4 (2%)	
Severe			
Extension deficit			
<3°	86 (93%)	205 (90%)	
3–5°	3 (3%)	17 (7%)	
6–10°	1 (1%)	1 (0.5%)	
>10°			
Not known	2 (2%)	5 (2%)	
Flexion deficit			
0–5°	87 (95%)	201 (88%)	
6–15°	2 (2%)	19 (8%)	
16–25°	1 (1%)	2 (1%)	
>25°		1 (0.5%)	
Not known	2 (2%)	5 (2%)	
Lachman test			p < 0.001
Hard	55 (60%)	219 (96%)	
Soft	37 (40%)	4 (2%)	
Not known		5 (2%)	
Pivot-shift test			p < 0.001
=contralateral	46 (50%)	207 (91%)	
Slight	31 (34%)	10 (4%)	
Marked	11 (12%)	2 (1%)	
Explosive	4 (4%)	2 (1%)	
Not measurable		7 (3%)	
Medial osteoarthritis			p = 0.021
None	82 (89%)	166 (73%)	
Mild	8 (9%)	43 (19%)	
Moderate	2 (2%)	12 (5%)	
Severe			
Not known		7 (3%)	
Lateral osteoarthritis			
None	87 (95%)	206 (89%)	
Mild	2 (2%)	11 (5%)	
Moderate	1 (1%)	3 (1%)	
Severe			
Not known	2 (2%)	8 (4%)	
Patellofemoral osteoarthritis			p = 0.003
None	71 (77%)	204 (89%)	
Mild	18 (20%)	16 (7%)	
Moderate	1 (1%)	2 (1%)	
Severe			
Not known	2 (2%)	6 (3%)	
IKDC			p < 0.001
A	14 (15%)	84 (37%)	
B	33 (36%)	96 (42%)	
C	28 (30%)	29 (13%)	
D	15 (16%)	8 (4%)	
Not known	2 (2%)	11 (5%)	
Differential laxity	4.2 ± 3.2 (0–13)	2.2 ± 2.4 (–6–13)	p < 0.001
Tegner score (100%)	4.1 ± 1.6 (2–6)	4.9 ± 1.6 (1–9)	p < 0.001
KOOS symptoms (0–100)	93.7 ± 13.4 (43–100)	84.9 ± 13.5 (38–100)	
KOOS pain (0–100)	88.1 ± 12.4 (28–100)	87.7 ± 12.3 (39–100)	
KOOS daily living (0–100)	89.6 ± 13.3 (22–100)	91.2 ± 10 (44–100)	
KOOS sport (0–100)	72.1 ± 23.9 (0–100)	74.6 ± 18 (100–100)	
KOOS quality of life (0–100)	71.2 ± 21.8 (0–100)	76.5 ± 18.4 (0–100)	p < 0.05
KOOS global (0–100)	84.4 ± 14.2 (22–100)	85.8 ± 11 (42–100)	
ACL-RSI (100%)	60.7 ± 27.2 (0–100)	70.8 ± 19.7 (0–100)	
Time to return to sport (days)		267 ± 107 (26–651)	

Severe preoperative laxity was a factor for poor prognosis in both groups. Clinical examination should therefore be precise and repeated, with follow-up of non-operated patients, who are more liable to show severe residual instability with impact on daily life and sport. In the NS group, high preoperative differential laximetry was predictive of poor IKDC score. In the surgical group, differential laximetry at follow-up was related to preoperative explosive pivot-shift test, lateral meniscal lesion, and use of hamstring graft. Factors for poor global KOOS score in NS comprised high BMI and skiing, and factors for poor Tegner score comprised skiing and/or team sports and moderate isolated medial

osteoarthritis. Female gender was associated with poorer global KOOS and IKDC scores. Complications, even when not operated on, seemed fundamental, impacting Tegner and IKDC scores and being associated with high differential laximetry at follow-up. Few risk factors are identified in the literature. Blyth et al. [2] highlighted chondral degeneration and also associated meniscal lesion, which generally corresponds to a long accident-to-surgery interval [21]. This was confirmed by Dham et al. [4] and Osti et al. [6]. Curado et al. [22] reported almost 30% moderate to severe osteoarthritis at 22 years, the main risk factors being meniscectomy, residual laxity and age >30 years at surgery. Trojani et al. [5]

Table 4
Late complications.

	Non-surgical, n (%) = 92 cases	Surgical (%) = 228 cases
Total	6 (7%)	33 (14%)
Reoperated	4 (4%)	29 (9%)
Meniscal lesion	2 (2%)	3 (1%)
Stiffness in extension		4 (2%)
Stiffness in flexion	1 (1%)	5 (2%)
Global pain		6 (3%)
Residual laxity/transplant tear	1 (1%)	2 (1%)
Not reoperated	2 (2%)	13 (6%)
Swelling	1 (1%)	1 (0.5%)
CRPS		3 (1%)
Femoral fixation site pain in anterolateral reconstruction		2 (1%)
Tibial fixation site pain in anterolateral reconstruction		1 (0.5%)
Failure with recurrent laxity	1 (1%)	
Patella syndrome		6 (3%)

reported previous medial meniscectomy to be predictive of persistent pain.

Decision-making can be guided according to clinical laxity: >5 mm differential laximetry at diagnosis should be an indication for surgery, especially in case of high physical and athletic demand. Conversely, low sport demand at the time of diagnosis may be an indication for non-operative treatment, with good results comparable to those of surgery although return to sport may be hindered.

Despite its prospective design, the present study had several limitations. Group sizes were unbalanced. The multicenter design may have led to differences in practices, and there was a center effect, with possible recruitment bias due to predominant locations in the Alps region; some centers were academic, with risk of variable surgical expertise. Also, follow-up was too short to assess the progression of chondral and meniscal lesions and the rate of re-tear. Even so, this was the largest reported series, even taking all 9 previously published series together. Follow-up was standardized across centers, with no loss to follow-up. And finally, to our knowledge, this was the first study comparing surgical versus non-surgical treatment of ACL tear in over-50 year-olds.

5. Conclusion

The present results were satisfactory in both the surgical and non-surgical groups, with significant and comparable improvement in global KOOS and ACL-RSI scores. On the other hand, IKDC score, stability and KOOS quality of life and Tegner scores were better in the surgical group, with easier return to sport and better quality of life. This was due to persistent laxity and instability, which were predictably greater in the non-operative group.

Preoperative laxity is the key factor for treatment decision-making and also for prognosis. Preoperative activity level and motivation are more important than mere age. In case of non-operative treatment, the patient needs to be informed that return to sport may be jeopardized.

Disclosure of interest

The authors declare that they have no competing interest.

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ME, RP, MO: writing introduction, results and discussion.
JFG, DD, HF: writing material and method.
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