

## Stability Tests in Knee Ligament Injuries

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**Summary.** For 182 knee joints with ligamentous injuries confirmed at surgery the records contained a complete and documented stability examination. In anterior cruciate ligament injuries the Lachman test and the anterior drawer sign were of similar value with regard to the frequency of false negatives – they missed half of the injuries – but their accuracy improved when they were repeated under anesthesia. The pivot shift was useful only under anesthesia. The medial collateral ligament injuries were usually detected because of valgus instability, also without anesthesia. The stability tests done with the patient under anesthesia are sufficiently reliable for making decisions about knee ligament surgery.

Regardless of their attitude toward treatment of knee ligament injuries, most investigators agree on the importance of a correct diagnosis. The introduction of knee arthroscopy was a major advance in this respect as it has improved our knowledge of knee trauma pathology [1, 3, 4, 6–9].

Clinical examination, even with the patient under anesthesia, has lately been regarded by some authors as insufficient in most knee injuries [10]. The objective of this study was to evaluate the efficacy of various clinical stability tests, and to compare examinations of knee joint stability with and without general anesthesia.

### Material and Methods

In the city of Malmö, orthopaedic emergency services for approximately 250000 inhabitants are provided in the Orthopaedic Emergency Room. Because of the health care delivery system the patients will also, if they have future complaints or

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complications, return to the Department of Orthopaedic Surgery for consultation.

During 40 consecutive months about 13000 visits to the Orthopaedic Emergency Room were because of knee conditions (Fig. 1). In all instances of suspected hemarthrosis due to recent trauma a joint aspiration was undertaken. The examination in all instances also included roentgen and stability tests.

Patients with unstable knees or in whom instability could not be ruled out and patients with hemarthrosis caused by sprain or obscure trauma without fracture were referred for a second examination of their knee stability, on the average 7 days after injury; this was performed by a group of experienced knee traumatologists.

At this second examination some patients were considered stable and were treated conservatively (Fig. 1). The remainder went on to examination under general anesthesia and were either operated on or treated conservatively, depending on the outcome. One group with stable joints were examined with arthroscopy (Fig. 1).

In the group examined without anesthesia three patients later were diagnosed as having an ACL injury; in the group considered stable when examined under anesthesia, three ACL injuries were also detected when the knees, for reasons other than instability, were examined with arthroscopy.

Complete stability examinations were recorded for 182 patients, including all the tests below performed with and without anesthesia. These patients had no signs of recent or previous injuries to the contralateral knee joint. The decisions with regard to stability or instability were in all instances based on a side-to-side comparison. The following stability tests were included:

**Table 1.** Etiology of knee ligament injuries in 182 patients

Cause	No. of knees
Soccer	79
Downhill skiing	35
Gymnastics	4
Volleyball	3
Other sports	27
Falling from heights	6
Falling on stairs	3
Other	20
Unknown	5

- (1) Valgus-varus stability with straight knee and in 20° of flexion
- (2) Anterior-posterior drawer sign in 90° of flexion
- (3) Anterior drawer sign in 20° of flexion (the Lachman test)
- (4) The pivot shift test

The average age of the patients was 27 (13–59); 119 were men. The etiologies of the injuries are presented in Table 1.

**Results**

The ligament injuries and the associated injuries discovered in conjunction with surgery are presented in Tables 2 and 3. The anterior drawer sign and the Lachman test were positive in approximately half of the cases without anesthesia and became positive under general anesthesia in most of the joints with

**Table 2.** Findings at surgical exposure

Finding	No. of knees
Isolated ACL rupture	92
Isolated MCL rupture	40
Combined ACL/MCL rupture	32
Combined PCL/MCL or PCL/LCL rupture	18

**Table 3.** Associated injuries

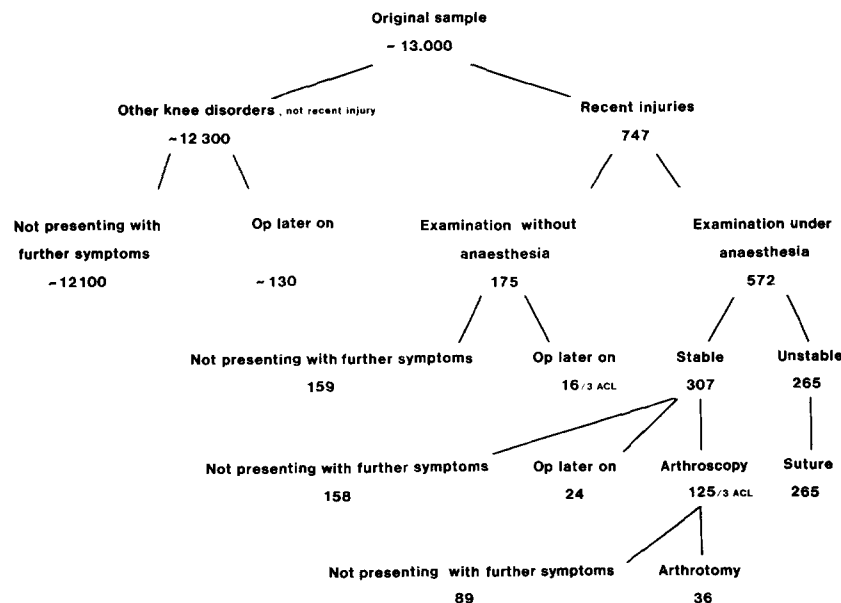
Main injury	n	Lesion of medial semilunar cartilage	Lesion of lateral semilunar cartilage	Chondral fracture
ACL	92	11	8	4
MCL	40	3	2	–
Combined ACL/MCL	32	4	–	1
PCL	18	1	3	–

**Table 4.** Positive findings

	Examination without anesthesia	Examination under anesthesia
<b>Isolated ACL injuries (n = 92)</b>		
Lachman	40 (43%)	82 (89%)
Anterior drawer	37 (40%)	68 (74%)
Pivot shift	4 (4%)	79 (86%)
Valgus instability	0 (0%)	0 (0%)
<b>Combined ACL/MCL injuries (n = 32)</b>		
Lachman	19 (59%)	28 (88%)
Anterior drawer	11 (34%)	29 (91%)
Pivot shift	3 (9%)	26 (81%)
Valgus instability	25 (78%)	32 (100%)
<b>MCL injuries (n = 40)</b>		
Lachman	2 (5%)	10 (25%)
Anterior drawer	2 (5%)	8 (2%)
Pivot shift	0 (0%)	0 (0%)
Valgus instability	32 (80%)	40 (100%)

ACL injury. The pivot shift sign was rarely positive without anesthesia but almost always became positive in ACL injuries (Table 4). In MCL injuries valgus instability was a criterion for surgery, and it was present in most instances even without anesthesia. In spite of apparent intact cruciate ligaments there was an anterior drawer sign or a positive Lachman test in several cases (Table 4). Eleven of 18 PCL injuries had a positive drawer sign without and 16 of 18 with general anesthesia.

Positive instability signs found without anesthesia were always present as well after general anesthesia was induced.



**Fig. 1.** Flow of patients during the examination period

**Table 5.** Sagittal instability; percent of positive preoperative findings in relation to peroperative findings

	Lachman		Anterior drawer		Pivot shift	
	EWA	EUA	EWA	EUA	EWA	EUA
Noyes et al. [7]			24	56	38	89
Zelko and Abrams [12]	94	100	50	69	–	–
Jonsson et al. [5]	87	100	33	98	–	–
Simonsen et al. [10]			66	84	–	–
Donaldson et al. [2]	99	100	70	91	35	98
Present study	48	89	39	78	6	85

EWA, Examination without anesthesia; EUA, examination under anesthesia

A review of those 265 knee joints (Fig. 1) that were considered unstable under anesthesia showed that no false positives were detected in conjunction with the operation.

## Discussion

The variable reliability of the Lachman test may be due to the variation in the skills of the investigators (Table 5). However, most authors agree that the Lachman test is better than the anterior drawer sign for the diagnosis of ACL injuries and that general anesthesia adds to the diagnostic precision [2, 5, 8, 10, 12].

The pivot shift was less often positive in ACL injuries in the present study than in similar studies of anterolateral rotation instability; again, this might be explained by the fact that in the early part of the study the surgeons were less familiar with the diagnostic procedure. The pivot shift is unreliable without anesthesia; therefore, modifications such as flexion rotational drawer (FRD) [7] are probably preferable.

Signs of sagittal instability only have been observed in only a few cases of MCL injury in the past [11]. The explanation for this may be a distension without rupture in the secondary sagittal stabilizers or even in the ACL itself. As expected, MCL injuries were in most instances detected as valgus instability even without anesthesia. It is suspected ACL component of an injury that requires the more reliable examination under anesthesia; these stability tests are so reliable that they can serve as a basis for decisions concerning surgical intervention.

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