

Reliability of Intraoperative Tests for Syndesmotic Disruption

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Abstract

Background: Management of the distal tibiofibular syndesmosis remain controversial area in the treatment of ankle fractures.

Objective was to evaluate reliability of intraoperative test for syndesmotic disruption including hook test and tap test and

compare it with preoperative radiographs. **Methods:** The study include 20 patients. Results: The mean age of the studied patients

was 36 years. Regarding gender, there was a male predominance; about two-thirds of the studied patients were males (60.0%). More

than one-third of the studied patients were from rural areas (40.0%). Also, more than one-third (40.0%) were smokers.

Syndesmotic disruption was detected in more than one-third of the patients (45.0%) by pre-operative radiographs. Hook test was

positive in half of the patients (50.0%), while tap test was positive in all patients (100.0%). When comparing results of hook and tap

tests to the reference pre-operative radiograph findings, hook test showed a sensitivity of 44.4%, specificity of 45.5%, PPV of

40.0%, NPV of 50.0%, and overall accuracy of 45%. Tap test

showed a sensitivity of 100.0%, specificity of 0.0%, PPV of 45.0%, NPV of 0.0%, and

overall accuracy of 45%. **Conclusion:** Tap test is better than hook test in detection of

Syndesmotic disruption and matching with preoperative radiograph Tap test is a simple, accurate and reliable technique for detection of syndesmotic instability. Diagnostic indices of

hook and tap tests demonstrated similar overall accuracy.

Keywords: Intraoperative; Syndesmotic; Disruption

Introduction

Management of the distal tibiofibular syndesmosis remain controversial area in the treatment of ankle fractures (1). The distal tibiofibular syndesmosis consists of

a complex ring of ligaments and the interosseous membrane that maintain the relationship of the tibia and fibula at the ankle mortise. Disruption of these

ligaments can lead to late instability, pain, and arthrosis (2).

Anatomic reduction is required to obtain satisfactory results; however, the amount of diastasis that can be tolerated is not universally accepted. Studies have shown as little as 1 mm of talar displacement can increase joint contact loads by as much as 42%. Precise diagnosis of distal tibiofibular syndesmotic injury is challenging, and preoperative radiographs rarely reveal subtle injuries as they provide only a static image (3).

Although ultrasonography (US), computed tomography (CT), magnetic resonance imaging (MRI), and arthroscopy have been described as possible alternative means of making this diagnosis, the most common and accessible approach remains a dynamic test intra-operatively at the time of treating these injuries. That being said, a gold standard diagnostic test has still not been established (2).

The intra-operative tests commonly in use when assessing for the presence of syndesmotic instability are the hook test and the external rotation stress test which have high inter-observer variance. An alternative technique called tab test using a 3.5mm blunt cortical tap has been described previously (4).

Our objective was to evaluate reliability of intraoperative test for syndesmotic disruption including hook test and tap test and compare it with preoperative radiographs.

Patients and methods

The cross-sectional study was done at Benha University orthopedic department and El-Helmia Military Hospital from November 2020 to May 2021.

The proposal of this study included 20 cases with ankle fractures treated with open reduction and internal fixation and evaluated for syndesmotic disruption intraoperative with both hook test and tap test after fracture fixation.

An informed consent was obtained from the patients before their enrollment in the study. The study was approved by the ethical committee of faculty of medicine, Benha University.

The inclusion criteria include:

- Skeletally mature patients with isolated lateral malleolus ankle fracture requiring open reduction and internal fixation.
- Skeletally mature patients with bimalleolar ankle fracture.

The exclusion criteria include:

- Younger patient (<16 years old).

- Isolated lateral malleolus ankle fracture not requiring open reduction and internal fixation.
- Open ankle fracture.
- Pathological fracture.
- Ankle fracture with significant peripheral neuropathy.
- Osteoporotic patients.

All patients were evaluated preoperatively using:

- **ATLS protocol.**
- **History taking**
- **Clinical Examination**
- **Routine preoperative labs:** including blood grouping and cross matching, liver, kidney functions, CBC, coagulation profile and Fasting Blood Sugar.
- **Radiological examination:** X-ray AP, lateral and mortise views of the affected ankle were carried to demonstrate fracture pattern. These films were evaluated for radiological signs of syndesmotic disruption:
 - Decreased tibiofibular overlap <6 mm in AP view and <1 mm in mortise view.
 - Increased medial clear space >4 mm on mortise view.
 - Increased tibiofibular clear space >6mm on both AP and mortise views.

Statistical methods

Data management and statistical analysis were done using SPSS version 25. (IBM, Armonk, New York, United States). Quantitative data summarized as means and standard deviations. Categorical data were summarized as numbers and percentages. Diagnostic indices, including sensitivity, specificity, PPV, NPV, and overall accuracy, were calculated for hook and tap tests using pre-operative radiograph findings as a reference.

Results

This study was conducted at Benha University Hospitals and El- Helmia Military Hospital and included 20 cases with ankle fractures treated with open reduction and internal fixation. Patients were evaluated for syndesmotic disruption intraoperative with both hook test and tap test after fracture fixation.

The mean age of the studied patients was 36 years. Regarding gender, there was male predominance; about two-thirds of the studied patients were males (60.0%). More than one-third of the studied patients were from rural areas (40.0%). Also, more than one-third (40.0%) were smokers. Syndesmotic disruption was detected in more than one-third of the patients (45.0%) by pre-operative

radiographs. Hook test was positive in half of the patients (50.0%), while tap test was positive in all patients (100.0%) (Table 2). Pre-operative radiographs detected syndesmotic disruption in 9 patients. Hook test results showed matching with positive pre-operative radiographs in 4 patients (44.4%) and mismatching in 5 patients (55.6%) (Table 3). Pre-operative radiographs detected syndesmotic disruption in 9 patients. Tap test results showed matching with

positive pre-operative radiographs in all nine patients (100.0%) table 4. When comparing results of hook and tap tests to the reference pre-operative radiograph findings, hook test showed a sensitivity of 44.4%, specificity of 45.5%, PPV of 40.0%, NPV of 50.0%, and overall accuracy of 45%. Tap test showed a sensitivity of 100.0%, specificity of 0.0%, PPV of 45.0%, NPV of 0.0%, and overall accuracy of 45% (Table 5).

Table (1) General characteristics of the studied patients

<i>General characteristics</i>		
Age (years)	Mean ±SD	36 ±8
Sex	Males n (%)	12 (60.0)
	Females n (%)	8 (40.0)
Residence	Rural n (%)	8 (40.0)
	Urban n (%)	12 (60.0)
Smoking	N (%)	8 (40.0)

Table (2) Detection of syndesmotic disruption by radiographs, hook test, and tap test

	n (%)
Preoperative radiographs	9 (45.0)
Hook test	10 (50.0)
Tap test	20 (100.0)

Table (3) Matching of hook test results with pre-operative radiographs

	Total	Hook test	
		Match	Mismatch
Syndesmotic disruption in preoperative radiographs	9(100.0)	4 (44.4)	5 (55.6%)

Table (4) Matching of tap test results with pre-operative radiographs

	Total	Hook test	
		Match	Mismatch
Syndesmotic disruption in preoperative radiographs	9 (100.0)	9 (100.0)	0 (0.0%)

Table (5) Diagnostic indices of hook and tap tests

	Hook test	Tap test
Sensitivity	44.40%	100.0%
Specificity	45.50%	0.0%
PPV	40.0%	45.0%
NPV	50.0%	0.0%
Overall accuracy	45%	45.0%

Discussion

We conducted a comparative study on patient with ankle fractures treated with open reduction and internal fixation and evaluated for syndesmotic disruption intraoperative with both hook test and tap test after fracture fixation. The study was carried out on 20 patients attending to orthopedic department in Benha university hospital and El-Helmia Military Hospital from November 2020 to May 2021 after approved by the ethical committee of faculty of medicine, Benha University.

Our study included 20 patients, the mean age of the studied patients was 36 years. Regarding gender, there was a male predominance; about two-thirds of the studied patients were males (60.0%). More than one-third of the studied

patients were from rural areas (40.0%). Also, more than one-third (40.0%) were smokers.

Syndesmotic disruption was detected in more than one-third of the patients (45.0%) by pre-operative radiographs. Hook test was positive in half of the patients (50.0%), while tap test was positive in all patients (100.0%).

Matching of hook test results with pre-operative radiographs detected syndesmotic disruption in 9 patients. Hook test results showed matching with positive pre-operative radiographs in 4 patients (44.4%) and mismatching in 5 patients (55.6%).

Matching of tap test results with pre-operative radiographs detected

syndesmotic disruption in 9 patients. Tap test results showed matching with positive pre-operative radiographs in all nine patients (100.0%).

When comparing results of hook and tap tests to the reference pre-operative radiograph findings, hook test showed a sensitivity of 44.4%, specificity of 45.5%, PPV of 40.0%, NPV of 50.0%, and overall accuracy of 45%. Tap test showed a sensitivity of 100.0%, specificity of 0.0%, PPV of 45.0%, NPV of 0.0%, and overall accuracy of 45%.

Other researchers (5) compared the Cotton and Tap tests for detection of coronal plane syndesmotic instability. Both tests demonstrated similar increases in the TFCS measurements in stressed injured conditions when compared to intact non-stressed and stressed conditions, as well as injured non-stressed conditions. The study results showed that the intraclass correlation coefficient for interobserver and interobserver reliability was respectively 0.96 and 0.79. TFCS measurements were similar in intact non-stressed, intact stressed (both Cotton and Tap tests) and injured non-stressed conditions, with 95% Confidence Intervals and different mean values of: intact non-stressed, 3.5 mm; intact stressed, 3.6 mm (Cotton test) and 4.0 mm (Tap test); injured non-stressed, 3.8

mm. The Cotton test and Tap test had, respectively, 73.3% and 70% sensitivity, 100% and 90% specificity, 86.7% and 80% diagnostic accuracy.

Another study (6), demonstrated that this novel coronal syndesmotic instability test using a 3.5 mm blunt cortical tap is a simple, accurate and reliable technique able to demonstrate significant differences in the tibiofibular clear space when injury was present. It could represent a more controlled and stable alternative to the most used Cotton test.

Previous study (7) showed that Interobserver agreement for the hook test and the clinical stress test was excellent, but the sensitivity of these tests was insufficient to adequately detect instability of the syndesmosis intraoperatively.

Other researchers (8) showed that for the detection of syndesmotic instability at the site of ankle fractures on stress radiographs, the lateral stress test appeared to be superior to the external rotation stress test in this cadaver model.

Conclusion

Obtaining an accurate syndesmotic reduction is critical in avoiding the significant morbidity that can be associated with malreduction. Anatomic

reduction of the fibula and syndesmosis has been associated with improved short musculoskeletal function assessment functional outcome scores, whereas malreduction leads to instability and arthritis. This study provide compare the Cotton and Tap tests for detection of syndesmotoc instability. Tap test is better than hook test in detection of Syndesmotoc disruption and matching with preoperative radiograph Tap test is a simple, accurate and reliable technique for detection of syndesmotoc instability. Diagnostic indices of hook and tap tests demonstrated similar overall accuracy.

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