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Ectopic varices in a right diaphragm that ruptured into the pleural cavity.

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Ectopic varices in a right diaphragm that ruptured into the pleural cavity.*

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Abstract

The term ectopic varices is used to describe dilated portosystemic collateral veins in unusual locations other than the gastroesophageal region. We recently experienced a rare case of ectopic varices that developed in the right diaphragm and ruptured into the pleural cavity. A 68-year-old female with hepatocellular carcinoma complicated with liver cirrhosis was admitted due to an acute onset of dyspnea and right bloody pleural effusion. Because of the patient's advanced hepatocellular carcinoma and poor condition, conservative therapies such as hemostats and blood transfusion were selected. Even though the bleeding to the pleural cavity stopped spontaneously, the patient died due to a progression of liver failure. Autopsy revealed a huge collateral vein in the right diaphragm. The etiology, prevalence, relationship with portal hypertension, and treatment of ectopic varices are discussed herein.

KEYWORDS: ectopic varices, portal hypertension, collateral vein, diaphragm

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Original Article

Interpreting Positive Signs of the Supraspinatus Test in Screening for Torn Rotator Cuff

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The purpose of this study was to investigate the validity of the supraspinatus test as a screening test for detecting torn rotator cuff and to determine what its valuable positive signs were. Both the empty-can test and full-can test were performed on 200 shoulders diagnosed by magnetic resonance imaging (MRI)—and in some cases, surgical findings—to have full-thickness or partial-thickness torn rotator cuffs, or no tear in the rotator cuff. During the maneuver, the presence of pain or weakness or both pain and weakness were recorded as positive signs, and the distribution of these signs were analyzed according to the degree of tear. The predictive values were calculated in 2 ways by considering (1) only full-thickness tears as tears and (2) both full- and partial-thickness tears as tears. The 2 tests and the 2 ways of considering partial-thickness tears were compared. Pain and weakness were severity-dependent, and the empty-can test had a higher incidence of pain. The sensitivities of the 2 supraspinatus tests in all positive signs were higher when including partial-thickness tears in the tear group; however, their specificities were higher when excluding partial-thickness tears. Both pain and weakness were interpretive for the supraspinatus test, and both tests were sensitive to full- and partial-thickness tears and specific for full-thickness tears.

Key words: rotator cuff, tear, screening, test

The clinical diagnosis of a torn rotator cuff is based on history and physical examination. Although a large tear can be diagnosed with confidence, small lesions affecting a single tendon may remain concealed. These tears usually involve the supraspinatus tendon [1, 2], which is the tendon most frequently compromised in patients with rotator cuff pathology [3]. A diagnostic method for detecting torn supraspinatus might be considered as a screening test for diagnosis of rotator cuff tear. At present the most useful test for rupture of the posterosuperior rotator cuff is considered to be the Jobe sign or empty-can test, which assesses the ability of the affected shoulder to maintain the arm in a position of 90 degrees of elevation in the scapular plane and in full internal rotation; this test elicits weakness or pain secondary to a tear [3]. Although different aspects of rotator cuff examination have been explored [4–9], only a limited number of studies have investigated the role of the supraspinatus test

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in predicting pathology compared with surgical findings; nonetheless, these studies have suggested the high sensitivity with low specificity of the tests [10–13]. In addition, some authors have reported more pain in the empty-can than in the full-can test [6, 10, 14]. Because of positional pain provocation in the injured shoulder, the interaction could affect cuff pathology [15]. Kelly *et al.* [14] reported that the optimal test for the supraspinatus muscle was 90 degrees of elevation and 45 degrees of external rotation ("full-can"), based on an electromyography study.

The purpose of this study was to evaluate pain and weakness as signs for interpretation of the supraspinatus test, and to observe and compare the validity of the 2 kinds of supraspinatus tests as screening tests for diagnosing torn rotator cuff. We report the tests' predictive values using 2 different categorization systems regarding partial-thickness tear, comparing them with findings of surgery or magnetic resonance imaging (MRI) as reference standards.

Materials and Methods

Between February 2004 and August 2005, 200 shoulders of consecutive patients with various shoulder symptoms were entered into a prospective study. The inclusion criterion was shoulder pain for more than 3 months which were undergone MRI. Exclusion criteria included acute pain within 3 months, bilateral shoulder pain, previous operation on the shoulder, fracture, inflammatory arthritis, infection and pain of cervical origin. There were 84 men and 116 women, aged from 37 to 83, with an average age of 59.5. There were 2 cases in their thirties, 43 cases in their forties, 72 cases in their fifties, 73 cases in their sixties, and 43 cases in their seventies. Thirty-eight cases had history of trauma such as falling down, but the other 162 cases had no history of trauma.

Both the empty-can test and full-can test were performed to assess the integrity of the supraspinatus muscle in each patient. For each test, the muscle strength was determined by manual muscle testing. The empty-can test was performed by subjects seated with arms abducted 90 degrees horizontally and rotated 45 degrees internally; the full-can test was done with arms abducted 90 degrees horizontally, and rotated 45 degrees externally. We determined that there was weakness if the patient could not resist downward pressure applied by the examiner, or if the strength was less than that of the intact side. The presence or absence of pain during the maneuver was also recorded. The authors interpreted the positive signs (pain and weakness) for 4 categories: pain (P) no matter it accompanied by weakness or not, weakness (W) no matter it accompanied by pain or not, just one sign of pain or weakness (P or W), or both pain and weakness (P and W).

The subjects underwent MRI. A 1.5-tesla magnetic-resonance scanner (General Electric, Milwaukee, WI, USA) was used. The findings were interpreted by a musculo-skeletal radiologic specialist. A full-thickness tear was diagnosed if a high-signal intensity occupied the full thickness layer of the rotator cuff tendon on T2-weighted image in both the coronal and sagittal planes. A partial-thickness tear was diagnosed when the fluid-intensity signal within the tendons was in contact with only one of the surfaces. Sixty-one (32%) of the 200 shoulders were subsequently operated on, and their diagnoses were mostly reconfirmed. In all, there were 66 cases of full-thickness tears, 71 cases of partial-thickness tears and 63 cases without a tear.

The distribution and proportion of the positive signs of each test were evaluated according to group as determined by surgery or MRI findings: *i.e.*, full-thickness tear group, partial-thickness tear group, and no-tear group. Differences between the empty-can test and full-can test were tested for significance with the Chi square test (x^2) for each criterion from the signs of tests and MRI and in some cases, surgical findings.

We divided the patient data into 2 groups: the tear group and no tear group. The analysis of 2 groups was performed in 2 ways: (1) by considering only full-thickness tears in the tear group, and (2) by considering both full-thickness and partial-thickness tears in the tear group. We calculated the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of the empty can and full-can tests for full-thickness tears of the supraspinatus tendon. Ninety-five percent confidence intervals were calculated as predictive values, for the comparisons of the positive signs of the 2 kinds of tests. The differences of predictive values between the 2

groups were calculated, both considering partial-thickness tears as part of the no-tear group (1) and as part of the tear group (2) with paired *t*-tests for each criterion. Statistical significance was set at $p = 0.05$.

Results

The incidences of positive signs on each test are described in Table 1. The full-thickness tear group had more positive signs in all categories; 'P', 'W', 'P or W', 'P and W' than in other groups. Likewise, the partial-thickness tear group had more positive signs than the no-tear group. The empty-can test had significantly higher incidence in difference in distribution of positive signs in 'P' in full-thickness (empty-can test 93.9%, full-can test 71.2%), partial-thickness (66.2%, 40.8%) and no-tear group (39.6%, 22.2%, $p < 0.05$). The incidences of 'P or W' and 'P and W' were higher in the empty-can test, but the differences were not statistically significant. There was no difference in 'W'.

The diagnostic values of the empty can and full-can tests are summarized in Table 2. The sensitivities of an empty-can test in 'P' (only full-thickness tears considered as tears 79.6%, partial-thickness tears included in tear group 93.9%), 'P or W' (83.9%, 98.5%), 'P and W' (55.5%, 71.2%) were higher than those of the full-can test in same criterion in both categorization schemes. Otherwise, the specificity of the full-can test for 'P' (only full-thickness tears considered as tears 77.8%, partial-thickness tears included in tear group 67.9%) and 'P or W' (68.3%, 53.7%) were higher than those of empty-can test in the same categorization schemes. The 95% confidence intervals for 2 tests overlapped for the positive predictive value, the negative predictive value, and accuracy in all criterions without significant difference.

When only full-thickness tears were combined into a single category, that is to say, partial-thickness tears considered as no tear, the specificity and positive predictive values in all positive signs; 'P' (specificity 60.3%, positive predictive value 81.3%), 'W' (88.9%, 92.1%), 'P or W' (58.7%, 81.5%), 'P and W' (90.5%, 92.7%) were higher than those of groups in which partial-thickness tears were considered tears. When partial-thickness tears were considered as tears, the sensitivity and negative predictive value of all positive signs; 'P' (sensitivity 93.9%, negative predictive value 93.9%), 'W' (75.8%, 85.5%), 'P or W' (98.5%, 98.3%), 'P and W' (72.2%, 83.9%) were higher than in the other group. The overall accuracies were modest (57.0–76.0%) for both tests (Table 2).

Discussion

The sensitivity and specificity of the empty-can test has been reported as 86% and 50% by Leroux *et al.* [12], 84% and 58% by Hertel *et al.* [10] and 100% and 53% by Ure *et al.* [13] respectively. High false-positive results and low specificity of the test in full-thickness tears and a lack of correlation between the functional impairment and size of the tear were reported [10–12]. Holtby and Razmjou [16] men-

Table 1 Distributions of the positive signs of 2 kinds of tests with magnetic resonance imaging and in some cases, surgical findings of rotator cuff tear.

Test	Complete tear	Partial tear	No tear	Total
Empty-can test				
P	62/66 (93.9%)	47/71 (66.2%)	25/63 (39.6%)	134/200 (67.0%)
W	50/66 (75.7%)	32/71 (45.0%)	7/63 (11.1%)	89/200 (44.5%)
P or W	65/66 (98.4%)	50/71 (70.4%)	26/63 (41.2%)	141/200 (70.5%)
P and W	47/66 (71.2%)	29/71 (40.8%)	6/63 (9.5%)	82/200 (41.0%)
Full-can test				
P	47/66 (71.2%)	29/71 (40.8%)	14/63 (22.2%)	91/200 (45.5%)
W	51/66 (77.3%)	31/71 (43.6%)	12/63 (19.0%)	95/200 (47.5%)
P or W	59/66 (89.3%)	42/71 (59.1%)	20/63 (31.7%)	121/200 (60.5%)
P and W	39/66 (59.1%)	18/71 (25.3%)	6/63 (9.5%)	63/200 (31.5%)

tioned that the supraspinatus test was not helpful for detecting full-thickness tears in general, but only for large or massive tears. The clinical or surgical criteria for a positive test are not noted clearly by other authors [10, 13] and comparison of the results of these studies was difficult. However, Itoi *et al.* [6] reported that both the empty-can and full-can test had high accuracy in diagnosis of supraspinatus tendon tear, but suggested that, considering the provocation of pain by the empty-can test, the full-can test may be more beneficial in the clinical setting, using muscle weakness alone as a criterion.

The authors tried to study pain and weakness as positive signs separately. The incidence of all positive signs are concomitant with the severity of the tear; however, the false positive rate of 'P' (39.6%) and 'P or W' (41.2%) in the empty-can test were higher than those of the full-can test (Table 1). The empty-can test was suggested to be more provocative of pain than the full-can test.

Because of the small number of normal shoulders and partial-thickness tears that could be confirmed by surgery and the probable relative inaccuracy of MRI for diagnosis of partial-thickness tears, we chose not to calculate predictive values for partial-thickness tears. Instead, we analyzed rotator cuff tears in 2 ways: first by including only full-thickness tears in the tear group, and then by combining partial-thickness tears and full-thickness tears in the tear group. With either approach, the predictive values of various categories of positive signs of the 2 tests on conditions where the partial-thickness tear group were significant. The empty-can test was considered to be sensitive (71.2–98.5%) for detecting both partial- and full-thickness tears. And both the empty-can test and full-can test were specific for detecting full-thickness

Table 2 Predictive values for empty-can test and full-can test in the diagnosis of rotator cuff tear, with analyses performed in 2 ways.

	Empty-can test		Full-can test	
	Only full-thickness tears considered as tears	Full and partial tears considered as tears	Only full-thickness tears considered as tears	Full and partial tears considered as tears
Sensitivity				
P	79.6	93.9	55.5	71.2
W	59.9	75.8	59.9	77.3
P or W	83.9	98.5	73.7	89.4
P and W	55.5	71.2	41.6	59.1
Specificity				
P	60.3	46.3	77.8	67.9
W	88.9	70.9	81.0	67.9
P or W	58.7	43.3	68.3	53.7
P and W	90.5	73.9	90.5	82.1
Positive predictive value				
P	81.3	46.2	84.4	52.2
W	92.1	56.1	87.2	54.2
P or W	81.5	46.0	83.4	48.7
P and W	92.7	57.3	90.4	61.9
Negative predictive value				
P	57.6	93.9	44.5	91.1
W	50.5	85.5	48.1	85.8
P or W	62.7	98.3	54.4	92.2
P and W	48.3	83.9	41.6	80.3
Accuracy				
P	73.5	62.0	62.5	69.0
W	69.0	72.5	66.5	71.0
P or W	76.0	61.5	72.0	65.5
P and W	66.5	73.0	57.0	74.5

tears. The especially high sensitivity of pain or weakness ('P or W', 98.5%) in the empty-can test for detecting full- and partial-thickness tears and the specificity of both pain and weakness ('P and W', 90.5%) in both empty can and full-can test for detecting full-thickness tear (Table 2) are noteworthy.

This study proceeded on the basis of the hypothesis that the findings of MRI and surgery were the same. The authors used both MRI and operative findings to assess the integrity of the rotator cuff tendon. MRI correctly identified 53 (98%) of the 54 full-thickness rotator cuff tears that were diagnosed in surgery. One shoulder was surgically discovered to be a partial-thickness tear after being diagnosed as full-thickness tear by MRI. Three shoulders that were suggested as partial-thickness tears through MRI were found to be full-thickness tears during surgery. We found that MRI was highly accurate for diagnosing full-thickness rotator cuff tears but less so for diagnosing partial-thickness tears, as was mentioned in a comparative study with ultrasonography [17]. We also experienced several cases of mismatched size of tears between the surgical findings and MRI; however, differences in tear size were not considered in this study. The validity of using MRI as a definitive diagnostic tool could be disputed. But our MRI system allows high-resolution MRI with 95 % accuracy [18] for full-thickness tears of the rotator cuff. Although the diagnostic accuracy of MRI is a little lower than that of surgical findings, the results were believed to be not so far from the truth. And not all subjects without torn rotator cuff could be confirmed by surgery practically.

Another limitation of the study was the interaction between muscle weakness and pain. Data about weakness might be added with isolation from pain by local injection. To lessen these biases the authors excluded patients having acute trauma within 3 months. Ben-Yishay *et al.* [15] mentioned that weakness in patients with full-thickness rotator cuff tear was more a product of pain than discontinuity of the musculotendinous unit. But the weakness was also severity-dependent as our data revealed, and these results are considered to be valuable for physicians at out-patient clinics. Studies about correlations between subjects with history of trauma and without should be performed in the future.

In conclusion, positive signs of both pain and weakness were concomitant with severely torn rotator cuff. The empty-can test was more pain provocative, and both the full-can test and empty-can test were equivocal to weakness. Pain or weakness was sensitive at detecting full- and partial-thickness tears in the rotator cuff, and both pain and weakness were specific to detecting full-thickness tears. Both the empty-can test and full-can test were considered to be valuable as screening tests to detect a torn rotator cuff, using the positive signs of pain and weakness separately in spite of their modest overall accuracy.

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