

CORRELATION BETWEEN DURATION OF SYMPTOMS OF ROTATOR CUFF TEAR AND ITS SEVERITY ASSESSED BY MRI AND ARTHROSCOPY- A MULTICENTRE CROSS SECTIONAL STUDY

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Abstract

Background: The duration of shoulder symptoms is used as an indication for full thickness rotator cuff tear repair. Our present multi-centre study is to determine if the duration of symptoms influences the features seen in patients with rotator cuff injury. Our hypothesis is that increasing duration of symptoms will correlate with advanced findings in MRI and arthroscopy, more pain and less muscle strength. **Material and Methods:** 68 patients with symptomatic rotator cuff tear were enrolled in this cross sectional study. Data collected at patient entry onto the study included: Duration of symptoms, Demographic data, History and Physical examination data, Radiographic imaging data and Arthroscopic findings. Statistical analysis included a univariate analysis with Kruskal-Wallis test and Mann Whitney U test to identify statistically significant relations with different duration of symptoms. **Results:** Duration of symptoms was not related to tear size, pain or weakness. Only fatty infiltration and atrophy of muscles showed a significant relation with duration of symptoms. **Conclusion:** Longer duration of symptoms did not correlate with advance findings in rotator cuff tear.

INTRODUCTION

Rotator cuff tears mostly present with shoulder pain, weakness, and loss of range of motion. Pain is usually a dull aching type and of insidious onset, and it extends over to the lateral aspect of arm and shoulder. Pain increases on overhead activities and also exacerbates during night, and may awaken the individual from sleep. Weakness is seen in advanced cases as inability to abduct the arm or elevate the arm. Immediate onset of weakness is seen in patients with acute tears, especially in association with trauma. Patients often describe difficulties in many daily activities like combing hair or securing it, on to remove wallet from back pocket.

There is wide disparity in literature regarding the correlation between the duration of symptoms and the outcome. A large retrospective study substantiated that duration of symptoms greater than one year is one of the three negative prognostic factors for non-operative treatment,^[23] and thus early operative intervention was recommended. Many other studies stated the same, less duration gave better results in operative interventions.^[24-26] Patients who experience symptoms for less than 3

months in duration has a greater outcome with non-operative management, stated another distinctive study.^[25]

Ellman et al 1986,^[27] determined that a longer duration of symptoms correlated with larger tears and increased difficulty of repair, although duration of symptoms did not directly correlate with outcome measures after repair. Oh et al 2007,⁸ a systematic review for indications for rotator cuff repair suggests that, non-operative management often fails when the duration of symptoms extend beyond one year.

Several studies showed that there was no correlation between duration of symptoms and treatment outcomes. A retrospective study in Finland from 1978 to 1983, in 78 patients with symptomatic chronic rotator cuff tear showed that preoperative symptoms had little predictive value in the final outcome after open repair.^[6] In this study, there were only few patients with short duration of symptoms as in with traumatic origin. Most patients in this study had chronic rotator cuff tears previously treated with physical therapy, local steroid injections or manipulation.

The diverseness and the disagreement in literature, regarding the correlation between duration of symptoms and the outcome may be attributed to factors associated with duration of symptoms, such as progression of size of tear, increased difficulty of repair of rotator cuff tendons that may have retracted much or even the degeneration over time of these tendons with fatty infiltration.

A systematic review by Wolf et al 2007,^[35] showed that factors that seem to be important include duration of symptoms, acuity of tear, weakness, size of the tear, and muscle atrophy and fatty infiltration. Furthermore, complicating this issue is that duration of symptoms does not necessarily reflect the duration a patient has had a cuff tear. Rotator cuff tears are not all symptomatic, and it is not well understood why these tears, even full thickness tears become symptomatic in some individuals and not in others. A study of 58 patients for progression of rotator cuff tear and development of symptoms, and had only unilateral symptoms were discovered to have rotator cuff tears by ultrasound in the contra lateral asymptomatic shoulder.^[22] About 51% of patients reported new onset of pain at follow up, and had loss off active elevation in addition to the onset of symptoms.

Vitale et al 1999,^[36] studied geographic variations in the rates of operative procedures involving the shoulder. This includes total shoulder replacement, humeral head replacement, and rotator cuff repair, showed that there are clear needs for well-designed clinical research to ascertain the factors that account for the variations and to examine the effectiveness and appropriate indications for the procedures.

Thus, a study to both, determine the existence of an association between duration of symptoms and rotator cuff tear and to examine a potential cause, which will help redesign the prevention and treatment protocol for rotator cuff tears, is inevitable. Ergonomic modifications aimed at screening of patients also may be warranted in future. Patient related factors like age, gender and comorbidities may also play a role in this association between duration of symptoms of rotator cuff tear and its severity.

MRI and Arthroscopy

The diagnosis of rotator cuff tears was revolutionised with the advent of Magnetic resonance imaging. Now it is described as a proved sensitive, accurate, cost-effective and a non-invasive tool in investigating shoulder pathology.^[37] MRI provides useful information about tear dimension, tear depth, tendon retraction, which can influence our treatment decisions. On magnetic resonance images, a full-thickness tear is diagnosed when there is complete disruption of all tendon fibers or when the signal within the cuff tendons was isointense compared with fluid on the T2-weighted images and extended from the articular to the bursal surface on one or more images^[38]. When fluid intensity signal within the tendons was in contact with only one of the surfaces, a partial-thickness tear was diagnosed

similarly, if there was discontinuity of some but not all tendon fibers on the magnetic resonance images, the diagnosis was a partial-thickness tear.^[38] Areas that are not seen in arthroscopy, like the internal structure of rotator cuff muscles are better visualised in MRI.

Literature also says about the false and misleading reports by MRI. Jonas et al,^[39] Torstensen et al,^[40] and Green et al,^[41] in their studies comparing accuracy of MRI and arthroscopy did not find MRI to be an accurate and effective tool for assessing shoulder pathologic conditions, especially in patients in whom the clinical picture cannot be assessed. The other disadvantage is that, it is contraindicated in patients who have a cardiac pacemaker, ferromagnetic foreign bodies (particularly in the orbit), and some cochlear implants.

Arthroscopy is considered as the gold standard in evaluation of shoulder joint pathologies. It provides a direct visualisation of the shoulder joint and also enhances it by magnifying around 20 X.^[42] The disadvantages of arthroscopy include inability to assess the flaccidity of a joint and that it is an invasive procedure thus carries small risks of complications such as infection, damage to adjacent structures (e.g. musculocutaneous nerve or articular cartilage) and fluid extravasation.

Duration

A large cross sectional study of 450 patients, Level III evidence, K.P. Unruh et al. showed that a longer duration of symptoms does not correlate with more severe rotator cuff disease, and thus only a weak relationship exists between duration of symptoms and features associated with rotator cuff disease^[43]. A prospective cohort study with consecutive patients who underwent 1-stage surgery between January 2012 and July 2014. Forty-four patients were enrolled in the long duration of symptoms group (Duration of symptoms ≥ 6 months), and 38 were enrolled in the short duration of symptoms group (duration of symptoms < 6 months). The patients were followed for a mean of 33.8 months, and the functional and radiographic outcomes were compared. The study concluded that a longer duration of symptoms greater than or equal to 6 months led to poorer functional outcomes and recommended that surgeons should propose a surgical treatment before symptoms persists for 6 months.^[44] A ten year multicentre evaluation of rotator cuff tear of isolated supraspinatus repair, showed that preoperative long duration has a significant detrimental effect on the functional outcome of rotator cuff repair.^[45]

MATERIALS AND METHODS

Our aim was to find any correlation between duration of symptoms of rotator cuff tear and radiological and arthroscopic assessment of advanced findings in rotator cuff tear severity.

It also included, finding out any existing relation between duration of symptoms of rotator cuff tear and patient related factors like age, gender and hand dominance. Two different hospitals were included in our study in a period extending from August 2017 to December 2021. All patients who were willing to participate and also has undergone arthroscopy for rotator cuff symptoms were included in the study. Patients with acute trauma, fractures, pain due to cervical or other pathologies, inflammatory arthritis, adhesive capsulitis, and who have undergone prior surgery to shoulder were excluded from this study. The different variables in this study include The duration of symptoms of the patient in months, Demographic data (like Age, Gender, Hand dominance), History information (like pain assessed by VAS scores^[46]), Physical examination findings (Strength of the muscles using MRC grades^[47]), Imaging findings (Size of the tear, Number of tendons affected, Retraction of the tendon, Atrophy of muscles and Acromial shape) and Arthroscopic findings (Size of tear, Number of tendons affected, Quality of muscles, and Acromial shape).

The patients enrolled provided data on demographics (like age, gender, hand dominance), comorbidities and historical information regarding intensity and severity of symptoms. Subjective pain was ranked by the patients on a visual analogue scale (VAS)^[48] in which 0 indicated no pain and 10 indicated extremely severe pain. They were asked to define the duration of symptoms as less than 3 months, three to five months, greater than or equal to six months.

Subjective pain was then classified into mild, moderate and severe, VAS scores ≤ 3.4 corresponded to mild impedance with functioning, whereas 3.5 to 6.4 implied moderate impedance, and ≥ 6.5 implied severe impedance.^[49]

We performed physical examinations of the patients and recorded information on areas of tenderness, active and passive range of motion, and strength measured with the Medical Research Council manual muscle testing^[50] (Grades 0-5). Muscle strength was assessed for abduction, flexion, internal rotation and external rotation of the shoulder joint. After MRI of the affected shoulder, The severity of the rotator cuff tear was graded based on the size of the tear, number of tendons involved; retraction of the rotator cuff tear in the coronal plane (minimal retraction, mid-humeral retraction, glenohumeral retraction, or retraction to glenoid as Classified by Patte^[51] as stage 1, stage 2 and stage 3). The degree of fatty infiltration (quality of tendon) was graded according to Goutallier^[10,52] staging. (grade 0 – normal muscle, grade 1 – some fatty streaks, grade 2- less than 50% fat muscle atrophy, grade 3- 50% fat muscle atrophy, grade 4 – more than 50% fat muscle atrophy) The shape of the acromion also was assessed (Bigilani^[53] classification) as Type 1- flat in shape, Type 2- curved and Type 3- hooked.

Finally, arthroscopic assessment including size of tear, retraction and condition of tendon was done. The data obtained was entered into Microsoft excel and analysed using statistical software (SPSS).

Ethical considerations and disclosures

Institutional ethical committee clearance obtained. Confidentiality of information was maintained throughout the study. Informed consent was obtained from all study subjects. No disclosures.

RESULTS

The mean age of the study subjects is 53.3(9.1) years with minimum age of 36 years and maximum age of 71years. 17.6 % of the study subjects were found to be less than 40 years or the younger age group. More than half the patients were of the middle age group, 41-50 around 11.85% and 51- 60 years around 52.9 %. The older chronological age group of more than 61 years were only a meagre 4.5%.

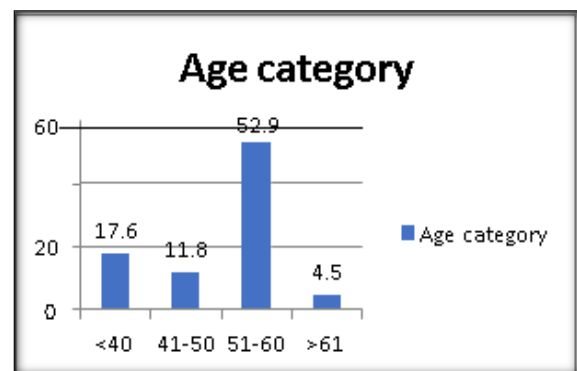


Figure 1: Age category

There were 42 males and 26 females in the study subjects. The males dominated the study with 61.2 %, while the females were around 38.2 % of the study population.

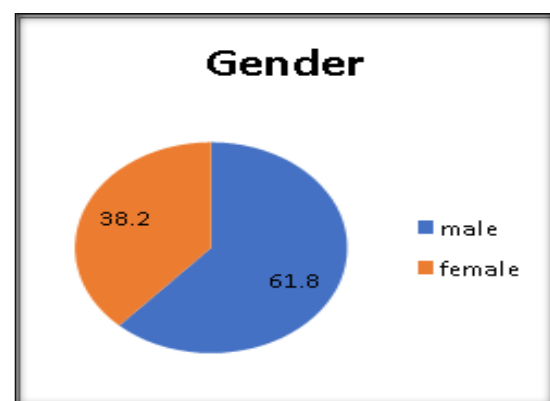


Figure 2: Gender

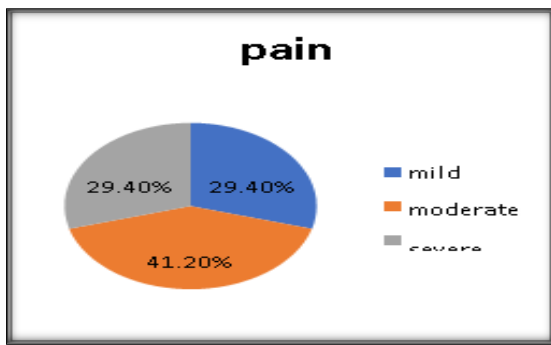


Figure 3: Pain

The pain was assessed using visual analog scale (VAS), No pain (0-4mm), mild pain (5-44mm), moderate pain (44-75mm) and severe pain (75-100mm). Mild pain was present in around 29.4% patients as similar to severe pain. Majority of the patients present with moderate pain 41.2%. In 70.6% (48) of the study subjects, had the dominant hand affected. In contrast, 29.4% (20), the non-dominant hand. The median duration of symptoms is 3months. Most of the patients (32) presented in a duration less than 3 months (47.1%). Only fourteen patients presented late with duration of symptoms \geq 6 months. 32.4% (22) patients presented around 3- 5 months of symptoms.

Duration in months	Number	Percentage
<3	32	47.1%
3-5	22	32.4%
\geq 6	14	20.6%

Muscle strength assessed clinically and was graded according to MRC grading. Abduction strength of shoulder was affected in most (67.6%- 46 patients) grade III power. Only 5.9% (8 patients) of the study subjects had grade V power in abduction. Internal rotation was affected in almost 80 % patients (41.2 % -28 patients, grade IV and 41.2 % -28 patients, grade III power). External rotation had grade IV power in 52.9% (36 patients) and grade V in 35.3% (24 patients) of the study subjects. 52.9 % (36 patients) of the patients had grade IV power in flexion and 35.3% (24 patients) had grade III power. Complete tears aggregate to 67.6% (46 patients) of the patients, while partial tears only amount to 32.4% (22 patients). Massive tears involving three tendons of the rotator cuff, were only 11.8% patients (8 patients), two tendons were affected in 41.2% patients (28 patients). Only one tendon was affected in 47.1 % patients (32 patients). To assess the quality of the tendons Goutallier ^[10] staging was done and 79.4 % of patients had no or minimal fatty infiltration. Grade 2 or less than 50% fatty muscle was seen in 14.7 % and 50% fatty muscle atrophy was seen in 5.9% of the patients. No retraction of the supraspinatus tendon was seen in 55.9% patients. 32.4% patients, tendon retracted till the humeral head. Around 5.9%, retracted tendon was at the level of glenoid and 5.9% near its bony insertion

on greater tuberosity of humeral head.58.8% patients had a normal acromion shape and only 41.2 % had type 2 acromion shape.

While arthroscopic showed complete tear was seen in 67.6% patients and partial tear in 32.4%. Massive tear with three or more tendons involved were only 5.9%.50 % patents had two tendons involved and 44.1% had only one tendon affected. Arthroscopic assessment of quality of tendons showed 94.1% as normal and only 5.9% as atrophied or friable tendons. No retractions of tendons were seen in 50%, while 35.3% had retraction of tendons until the humeral head and 14.7% till the glenoid. Type 2 acromion was seen in 41.2 % patients, while the rest had a normal acromial shape.

Relation with duration of symptoms

Pain - Median duration of symptoms in months were found to be more in males than females ($p = 0.007$). Patients with severe pain presented early with less duration of symptoms, while patients with only mild pain presented late ($p=0.002$). Right hand dominant or left-hand dominant did not alter the duration of symptoms ($p=0.523$). Age of the patients showed no correlation with duration of symptoms.

Strength of muscles- Patients who had less strength of abduction (grade 3) presented earlier with less duration of symptoms (1 month- median duration of symptoms) ($p=0.012$). Internal rotation was also significant with grade 3 strength presenting earlier ($p=0.047$). External rotation and flexion had no significant correlation with duration of symptoms

MRI findings- The median duration of symptoms did not have any variation between complete or partial tears ($p=0.403$). Patients with three tendons affected presented earlier than patients with two tendons or even one tendon affected. ($p=0.004$). Tendon retraction had no relation with duration of symptoms ($p=0.536$). In addition, patients with normal tendon quality presented earlier than patients with fatty infiltration in the tendons ($p=0.039$). The acromion shape had no correlation with the median duration of symptoms.

Arthroscopy - The patients with complete tear presented earlier with median duration of symptoms of 1 month, while patients with partial tear presented late ($p=0.034$). The number of tendons affected, the retraction of tendons, the quality of the tendons or the acromion shape had no relation with duration of symptoms.

To summarise, our results, the median age of presentation was 53.3 years and male gender was more (61.2 %) of study subjects. Most of the patients (41.2%) had moderate levels of pain. Only 23.5% were Diabetic, and 70.6% with dominant hand affected. Patients presenting with duration of symptoms of less than 3 months were more (47.1%). Duration was also more in males than females with a p value of 0.007. Patients with severe pain and less muscle strength (grade 3) of abduction and internal rotation had less duration of symptoms. In radiological evaluation, patients with multiple tendons affected had less duration of symptoms and

those with more duration of symptoms had fatty infiltration in the tendons, while other parameters had no statistically significant relationship. Whereas in arthroscopy, patients with partial tear had longer duration of symptoms than with complete tears. No other parameters showed a statistical significance.

DISCUSSION

Patients with severe pain and symptoms do present early than the ones who are having mild or moderate symptoms and noted to be statistically significant with a p value of 0.002. Severe symptoms or pain hampering daily activities urge a visit to an Orthopaedic surgeon. Natural history studies have demonstrated that pain maybe associated with progression or even enlargement of rotator cuff tear. Yamaguchi et al, studied the progression of asymptomatic rotator cuff tears, Out of 23 patients, fourteen became symptomatic, and of the fourteen, seven had progression of tear.^[22] Thus the tear progression or tear severity maybe one of the factors to present earlier as in our study.

Patients with three or more tendons affected appeared to have lesser duration of symptoms with a p value 0.004 (<0.05). This may be attributed to the fact that, patients with severe tear of rotator cuff present early. This finding is in agreement to many studies, which studied the natural progression of rotator cuff tears. Yamaguchi et al, studied progression of rotator cuff tears and noted that asymptomatic rotator cuff tears on tear progression became symptomatic.^[22] Moosmayer et al also had a similar study, which studied patients with asymptomatic rotator cuff tear. This study too demonstrated that newly symptomatic patients had an increase in tear severity or tear progression.

As already demonstrated by Goutallier et al, in agreement to our study, as the duration of symptoms increased, the fatty infiltration of the tendons also increased. Our study also demonstrated a similar pattern, as the patients who presented early in first month had no signs of fatty infiltration in their magnetic resonance images, whereas those patients who presented late by four months or more than four months had developed fatty infiltration of their torn rotator cuff muscles.

Arthroscopic evaluation and its statistical assessment showed that patients with complete tear presented earlier for a surgical management than those with partial tears. The patients with partial tears are bestowed a line of conservative management in the initial period of symptoms and thus may correlate to the finding obtained. No other variable showed any statistical significance. The median duration of symptoms varied randomly in relation with severity of tear of rotator cuff tendon.

Similar study by Unruh et al, studying 450 patients, a Level III cross-sectional study conclude that there is only a weak relationship between duration of

symptoms and features associated with rotator cuff tear severity.^[43]

Ten-year multicentre trials by Collin et al, recommended early repair of rotator cuff tear, and as duration increases, more fatty muscle atrophy and a detrimental effect on long term functional outcome of rotator cuff tear.^[45] Another cross-sectional study by Dunn et al, of 393 patients with rotator cuff tear, showed that anatomic features defining rotator cuff do not correlate with severity of rotator cuff tear.^[5]

Many patients are relieved by non-operative treatment of rotator cuff tear, thereby suggesting that symptoms do not correlate with severity of tear.

CONCLUSION

Despite all these limitations, this multi-centre study in our population of patients with symptomatic rotator cuff tear, found out that severity of rotator cuff tear, like tear size, number of tendons affected does not depend upon the duration of symptoms. Longer duration of symptoms showed fatty infiltration of tendons of the cuff, which warrants further studies. Physical examination findings like pain and muscle strength too had no relation with longer duration of symptoms. Age and gender also had no relation with duration of symptoms.

Thus, our study did not find any relation between arthroscopic or radiological severity of rotator cuff tear and the duration of symptoms.

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