Oral Steroid Therapy for Frozen Shoulder

K Takase

ABSTRACT

Background: *Since frozen shoulder is characterized by spontaneous recovery, no precise treatment strategy exists. Both conservative therapy and arthroscopic surgery is available, but the time required for recovery varies considerably. This study looks at the possible early symptom relief with oral steroid therapy.*

Subjects and Methods: *The subjects were 76 patients aged 33 to 73 years at the beginning of the study. The duration of the frozen shoulder was one to 15 months (mean 5.7 months) and hypertension was noted in 13 patients as a complicated disorder. A single course of steroid therapy consisted of a total dose of 105 mg of prednisolone over approximately a three-week period by the dose-tapering method. The number of courses varied with the degree of symptom relief, but the rest period between courses was always approximately four weeks. The results were assessed on the basis of the Japanese Orthopaedic Association (JOA) score, but the principal evaluations were pain and range of motion.*

Results: *The average ranges of motion before treatment were 102.8° of forward flexion 11.3° of external rotation and internal, rotation was at the buttocks. However, after one course of treatment, forward flexion was 136°, external rotation was 33.7°, and internal rotation was limited to the buttocks in only six cases.*

Conclusion: *The results of oral steroid therapy for frozen shoulder were highly satisfactory. However, sufficient care is required in explaining the method of administration and the adverse effects such as the osteonecrosis of the femoral head or osteoporosis.*

Keywords: Frozen Shoulder, gallium scintigraphy, oral steroid therapy, osteonecrosis of the femoral head

Terapia de Esteroides Orales para el Hombro Congelado

K Takase

RESUMEN

Antecedentes: *Como que el hombro congelado se caracteriza por la recuperación espontánea, no existe una estrategia de tratamiento precisa. Tanto la terapia conservadora como la cirugía artroscópica se hallan a disposición, pero el tiempo requerido para la recuperación varía considerablemente. Este estudio echa una ojeada al posible alivio de los síntomas tempranos por medio de la terapia de esteroides orales.*

Sujetos y Método: *Los sujetos fueron 76 pacientes en edades de 33 a 73 años al comienzo del estudio. La duración del hombro congelado fue de 1 a 15 meses (promedio 5.7 meses), y se observó hipertensión en 13 pacientes como una condición co-mórbida. Un solo tratamiento con esteroides consistía en una dosis total de 105 mg de prednisolona por un período de aproximadamente tres semanas mediante el método de reducción gradual de la dosis. El número de tratamientos varió de acuerdo con el grado de alivio del síntoma, pero el período de descanso entre tratamientos fue aproximadamente de cuatro semanas. Los resultados fueron evaluados sobre la base de la puntuación establecida por la Asociación Ortopédica del Japón (JOA), y las evaluaciones principales fueron el dolor y el alcance del movimiento.*

Resultados: *El rango promedio del movimiento antes del tratamiento fue 102.8° de flexión delantera, y 11.3° de rotación externa y la rotación interna fue en las nalgas. Sin embargo, luego de un tratamiento, la flexión delantera fue 136°, la rotación externa fue 33.7°, y la rotación interna estuvo limitada a las nalgas en sólo seis casos.*

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Conclusión: *Los resultados de la terapia de esteroides orales para el hombro congelado, fueron altamente satisfactorias. Sin embargo, se requiere suficiente cuidado al explicar el método de administración y los efectos adversos, tales como la osteonecrosis de la cabeza del fémur o la osteoporosis.*

Palabras claves: Hombro congelado, cintigrafía con galio, terapia de esteroides orales, osteonecrosis de la cabeza del fémur

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INTRODUCTION

Frozen shoulder is considered to be a disorder that presents primarily with pain and restriction of range of motion of the shoulder joint, and resolves spontaneously with time. However, the disorder has a protracted natural course lasting an average of two or three years, and is characterized by spontaneous onset of shoulder pain and progressive global stiffness of the glenohumeral joint accompanied by significant disability (1, 2). Its pathology is based on degenerative changes of soft tissues that constitute the shoulder but the focus of the change is unclear. Its treatment varies with the stage of the disorder, requiring surgical treatment in some patients (3, 4) but there is no consensus for any one type of treatment. We have treated the disorder using oral corticosteroid as the first choice regardless of the stage. In conducting oral steroid therapy, the administration method and dose must be determined in consideration of the occurrence of adverse effects (the osteonecrosis of the femoral head or osteoporosis). In this study, the administration method and dose was established, the therapeutic results, presence or absence of adverse effects, and relationship between findings on Gallium (Ga) scintigraphy before oral steroid therapy and the effectiveness of the therapy were evaluated.

SUBJECTS AND METHODS

To clearly define frozen shoulder, disorders that can be diagnosed according to imaging findings such as full-thickness rotator cuff tear and calcification were excluded, and the following patients were selected as the subjects: those who have restriction of range of motion and pain of the shoulder interfering with ADL, no clear history of trauma, no pain or muscle weakness on the supraspinous muscle test (empty can test), infraspinous muscle test, or belly press test; no radiological evidence of osteoarthritis of the shoulder or fracture and no clear abnormal signals in the rotator cuff on MR images.

The subjects were 76 patients (42 males and 34 females) aged 33−73 years (mean 55.5 years) at the beginning of treatment. The affected side was the right in 48 and left in 28, the duration of the disorder was 1−15 months (mean 5.7 months) and hypertension was noted in 13 patients as complicated disorders.

Patients with oral steroid therapy were given prednisolone 5 mg tablet. The dosing method and the dose were determined taking into consideration the occurrence of adverse effects, *ie*, osteonecrosis of the femoral head or osteoporosis. The medication was administered twice a day for five days, then once a day for the next six days and finally once a day every other day for the next 10-days, to a total dose of 105 mg (21 tablets). This regimen was regarded as one course. This course was repeated, if necessary, with a one-month drug-free period after each course by evaluating symptomatic changes. Of 76 patients, the oral steroid therapy was performed over only one course in 40, 2 courses in 24, 3 courses in 9, 4 courses in 1 and 5 courses in 2. As a concomitant therapy, which was also continued during the drug-free periods, only pendulum exercise of the shoulder was prescribed with no other physiotherapy or administration of oral non-steroidal anti-inflammatory drugs (NSAIDs).

Gallium scintigraphy was performed in 52 out of 76 patients before oral steroid therapy. As the comparative group, only pendulum exercise of the shoulder was prescribed without oral steroid therapy in 5 patients (2 males and 3 females) aged 37−57 years (mean 45.3 years) with a 3−12 month (mean 6.0 months) history of the disorder.

Pain (resting pain, night pain and activity related pain) and the range of motion (forward flexion, external rotation with the arm at the side and internal rotation) of the shoulder were evaluated. The results were statistically analysed using the Mann-Whitney's U-test, and Spearman's rank correlation coefficient was evaluated for comparisons according to the duration of the disorder in months. A p-value of 0.05 was taken to be significant.

RESULTS

Activity-related pain was recognized in 71, resting pain in 38, and night pain in 49 patients before the oral steroid therapy, but improved in 15, 1 and 1, respectively, at two months after one course of oral steroid therapy. The Japanese Orthopaedic Association score concerning pain (full mark 30) was 5 to 25 (mean 10.5) before treatment, but improved to 10 to 30 (mean 25.5) at 2 months after 1 course of oral steroid therapy. Concerning the range of motion also, forward flexion improved from 40−160° (mean 102.8°) before treatment to 70−180° (mean 136°) at two months after one course of oral steroid, with an improvement of 0 to 90° (mean 33.2°), but no improvement was noted in three patients even after two courses (Fig. 1). External rotation with the arm at the side improved from -20 to 70° (mean 11.3°) before treatment to -10 to 70° (mean 33.7°) at two months after one course of oral steroid therapy, with an

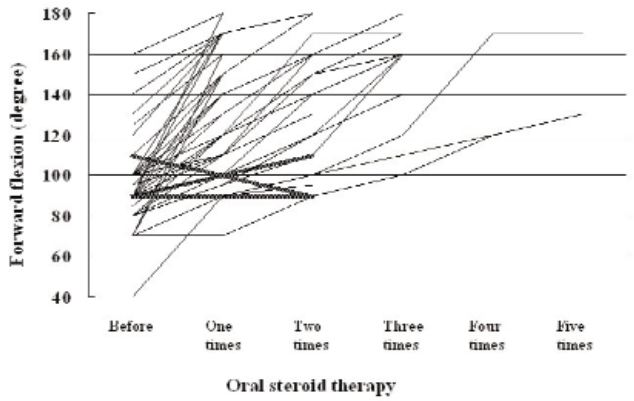

Fig. 1: Improvement of forward flexion. The forward flexion improved from 40−160° (mean 102.8°) before treatment to 70−180° (mean 136°) at two months after one course of oral steroid, with an improvement of 0 to 90° (mean 33.2°), but no improvement was noted in three patients (thick line) even after two courses.

improvement of -10 to 60° (mean 22.1°), but no improvement was observed in six patients, of whom two also showed no improvement in forward flexion (Fig. 2). Internal rotation

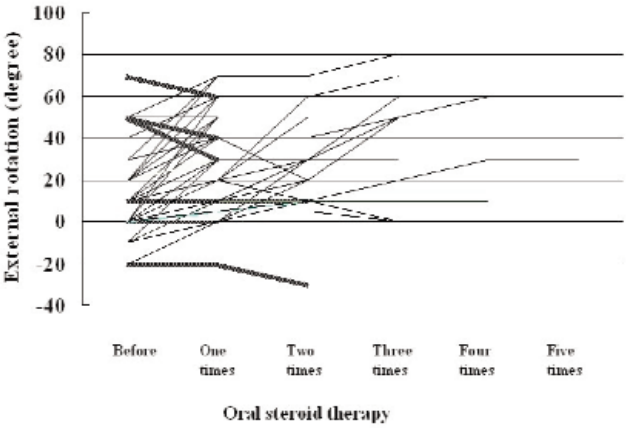

Fig. 2: Improvement of external rotation. The external rotation with the arm at side improved from -20 to 70° (mean 11.3°) before treatment to -10 to 70° (mean 33.7°) at two months after one course of oral steroid therapy, with an improvement of –10 to 60° (mean 22.1°), but no improvement was observed in six patients (thick line), of whom two also showed no improvement in forward flexion.

improved from -1 to 7 vertebral bodies (mean 2.6 vertebral bodies), and improvement was eventually observed in all but three patients (Fig. 3). Table 1 shows improvements in the range of motion of the shoulder both at two months after one course of oral steroid therapy and at the final consultation. About 70% or more of the improvements observed at the final assessment had been achieved within two months after one course of oral steroid therapy.

Table 2 shows the results of statistical analyses according to gender, age and symptomatic period. The evaluation

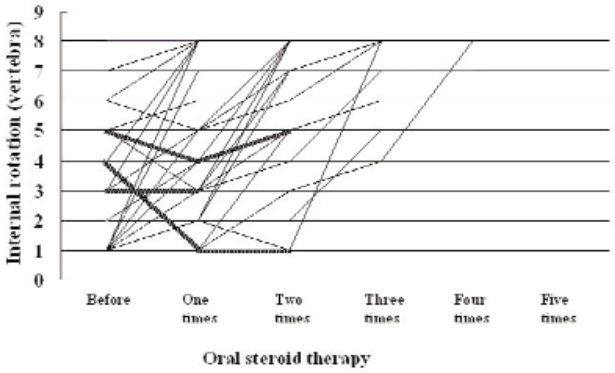

Fig. 3: Improvement of internal rotation. The internal rotation improved from -1 to 7 vertebral bodies (mean 2.6 vertebral bodies) and improvement was eventually observed in all but three patients (thick line).

Table 1: Comparison in the improvement of the range of motion between at two months after one course of oral steroid therapy and at the final consultation.

	Forward flexion	External rotation	Internal rotation
Evaluation after one course	0 ~ 90 degrees (mean: 33.2)	-10 ~ 60 degrees (mean: 22.1)	-1 ~ 7 verte (mean: 2.6)
Final evaluation	0 ~ 90 degrees (mean: 49.1)	-20 ~ 70 degrees (mean: 28.7)	0 ~ 7 verte (mean: 3.8)

was made using the improvement at two months after one course of oral steroid therapy as a reference. Related to the symptomatic period, each factor was evaluated based on monthly periods or three different symptomatic periods (less than 3 months in 23, 3−6 months in 24 and 7 months or longer in 29). Age correlated significantly only with the improvement in the range of internal rotation. The symptomatic period affected the improvement in pain. Particularly, there was a significant difference between the improvement in pain within three months and those seven months or longer.

However, the symptomatic period had no effect on the improvement in the range of motion. Significant accumulation was noted on the affected side compared to the non-affected side in 45 of the 52 patients who were evaluated using Gallium scintigraphy (Fig. 4). The sites of accumulation were near the rotator interval in the anterior part of the shoulder in all 45 patients, and in both the anterior and posterior part in six patients. No accumulation was noted in the acromioclavicular joint.

No symptomatic improvement was noted in two out of five patients prescribed only pendulum exercise without oral steroid therapy for four months. Thus, a course of oral steroid therapy was given to the two patients and symptoms resolved immediately resulting in marked improvements in pain and range of motion (Fig. 5).

Table 2: The statistical analyses between the improvement of each factor and gender, age or symptomatic period. The evaluation was made using the improvement at two months after one course of oral steroid therapy as a reference.

	Improvement of pain	Improvement of F. F.	Improvement of E. R.	Improvement of I. R.
Age	$p = 0.95$	$p = 0.17$	$p = 0.95$	$p = 0.03$ r = 0.35
Gender	$p^* = 0.46$	$p^* = 0.50$	$p^* = 0.50$	$p^* = 0.63$
Symptomatic periods	$p = 0.03$ r = -0.34	$p = 0.24$	$p = 0.61$	$p = 0.65$
less than 3 months	NS	NS	NS	NS
3 to 6 months	NS ($p^* = 0.04$)	NS	NS	NS
more than 7 months	NS	NS	NS	NS

p *: Mann-Whitney's U – test
p: Spearman's rank correlation coefficient

Table 3: The correlation between the presence or absence of significant accumulation compared to the non-affected side on Ga scintigraphy and improvement in the range of motion

	Forward flexion	External rotation	Internal rotation
Presence of significant accumulation	0 ~ 70 degrees (mean: 37.5)	0 ~ 60 degrees (mean: 26.3)	1 ~ 7 verte (mean: 2.9)
Absence of significant accumulation	0 ~ 30 degrees (mean: 10.0)	0 ~ 20 degrees (mean: 10.0)	0 ~ 2 verte (mean: 1.0)

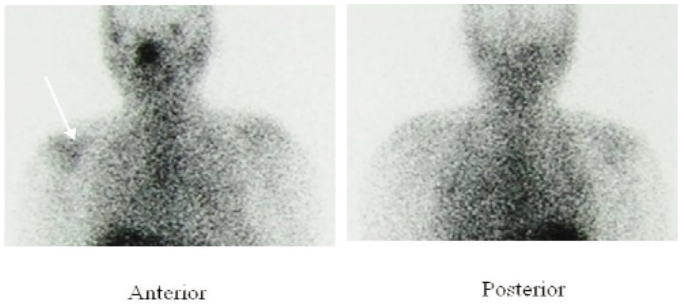

Fig. 4: Gallium scintigraphy. Significant accumulation (white arrow) was noted on the affected side compared to the non-affected side in 45 of the 52 patients. The sites of accumulation were near the rotator interval in the anterior part of the shoulder in all 45 patients, and in both anterior and posterior part in six patients.

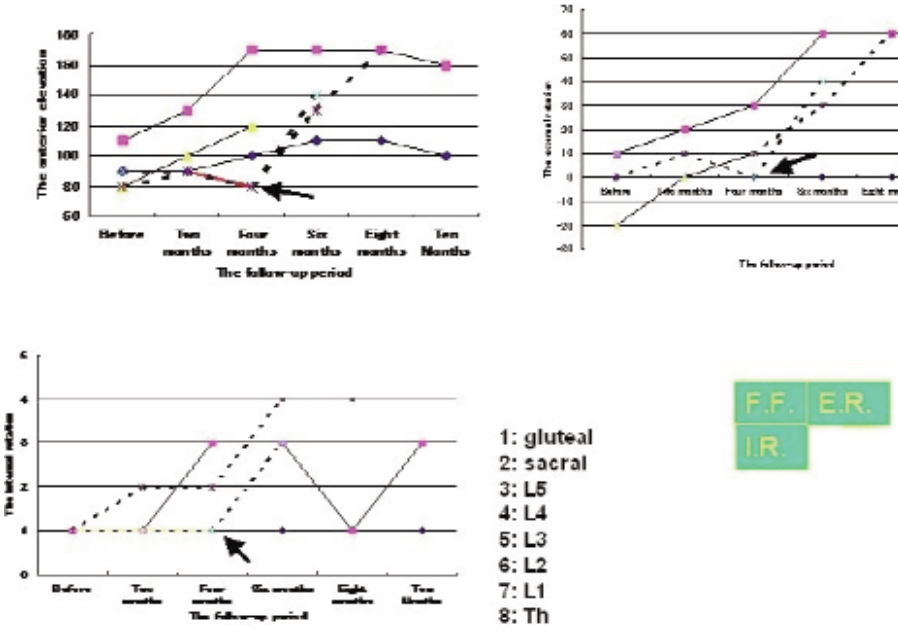

Fig. 5: The range of motion on five patients prescribed only pendulum exercise without oral steroid therapy. No symptomatic improvement was noted in two out of five for four months. Then, we prescribed one course of oral steroid therapy (black arrow) for the two patients at four months. Their symptoms were resolved immediately resulting in marked improvements in the range of motion (F. F.: forward flexion, E. R.: external rotation, I. R.: internal rotation).

DISCUSSION

Frozen shoulder is classified into the painful (freezing), progressive stiffness (frozen), and resolution (thawing) phases (5). General pathological features are mainly regressive changes in soft tissues that constitute the shoulder (6, 7), but no clear lesion has been reported. For this reason, various treatments have been attempted and reported. Typical treatments are analgesic therapy (8), physiotherapy (9) [relieve pain, improve motion and restore function], local injection therapy (10, 11) [into the subacromial bursa, tendon sheath of the long head of the biceps brachii muscle or glenohumeral joint], capsule distension (12) [pumping therapy], manipulation (13, 14) under general anaesthesia, release of the coracohumeral ligament (15) and arthroscopic release of the capsule and glenohumeral ligament (16). Less invasive treatments such as analgesic therapy, physiotherapy, and injection therapy may produce some therapeutic effects depending on the stage of the disorder but the treatment may be protracted. However, surgical treatments such as manipulation under general anaesthesia, release of the coracohumeral ligament, or arthroscopic release of the capsule and glenohumeral ligament is selected for the frozen shoulder refractory to conservative treatment.

In 1987, Neviaser (17) suggested that inflammation of the rotator interval including the coracohumeral ligament was a cause of adhesive capsulitis. Thus the use of oral steroid therapy for frozen shoulder in this study. However, adverse effects of steroids must be sufficiently understood for the determination of the administration method and dose. Concerning steroid-induced osteonecrosis of the femoral head, Kubo *et al* (18) examined the femoral head by MR images (MRI) in patients after long-term steroid administration, and reported that MRI findings suggestive of osteonecrosis appeared six weeks after oral steroid therapy, at the earliest, even on steroid tapered therapy. Hirota *et al* (19) reported that the osteonecrosis is likely to occur at a mean minimum dose of 16.6 mg or higher. Based on these findings, the administration method was determined as a period not exceeding six weeks with a daily dose not exceeding 10 mg. Also, concerning steroid-induced osteoporosis, van Staa *et al* (20) reported that the bone mineral density began to decrease within one month of oral steroid therapy and markedly decreased after six months. Laan *et al* (21) suggested that the bone mineral density significantly decreased when the dose of oral steroid was 7.5 mg/day or higher and that it recovered after the discontinuation of oral steroid therapy although it depended on the dose and administration period. According to their suggestion, a regimen of oral steroid therapy was established so that the administration period did not exceed four weeks, that a four-week drug-free interval must be set between courses and that the administration must be avoided if the bone mineral density is less than 70%.

Satisfactory improvements have been obtained regarding pain and the range of motion of the shoulder, and marked improvements have been observed in a short period such as two months. In addition, the therapeutic results were not affected by age, gender and symptomatic period. Two or more courses were necessary in about 50% of the patients but no recurrence or complaint of low back or hip pain was noted in any patient. However, the subjects were only the group prescribed oral steroid, and comparisons with a natural course group, oral NSAIDs group, and less invasive treatment group undergoing physiotherapy and local injection therapy are necessary for the future.

Finally, we evaluated the correlation between the presence or absence of significant accumulation compared to the non-affected side on Gallium scintigraphy and improvement in the range of motion. The mean improvement at two months after oral steroid therapy (one course) was 37.5° in forward flexion, 26.3° in external rotation and 2.9 vertebrae in internal rotation in patients with significant accumulation. These improvements differed significantly in those without accumulation ($p = 0.01$); 10° in forward flexion, 10° in external rotation and one vertebra in internal rotation, respectively (Table 3). From these results, Gallium scintigraphy is considered to be useful for the prediction of the effectiveness of oral steroid therapy.

CONCLUSIONS

In summary, oral steroid therapy is considered to be effective as a conservative treatment for frozen shoulder. However, sufficient care and informed consent from patients are necessary because of the possibility of adverse effects such as osteonecrosis of the femoral head and osteoporosis.

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