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Surgical Treatment for Chronic Lower Leg Compartment Syndrome in Young Female Athletes

ABSTRACT & COMMENTARY

Synopsis: *Teenage female athletes are more susceptible to chronic lower extremity compartment syndromes than are men. Females seem to respond less well to surgical decompression.*

Source: Micheli LJ, et al. Surgical treatment for chronic lower-leg compartment syndrome in young femal athletes. *Am J Sports Med* 1999; 27(2):197-201.

Micheli has a long-standing interest in the treatment of chronic lower extremity compartment syndromes and, between 1980 and 1997, he performed fasciotomies on 53 teenage female athletes with chronic, lower leg compartment syndrome. Despite a typical balance between the sexes with regard to sports-related injuries in his clinic, a much smaller number of male teenage athletes eventually underwent surgery for the same problem. This review presents the results of the fasciotomies for chronic compartment syndrome in this group of young female athletes.

Forty-seven of the 53 patients were seen in follow-up at an average of 4.2 years after surgical treatment. The mean age of the patients at the time of treatment was slightly more than 17 years. Virtually all were involved in varsity athletics at the high school or college level. The diagnosis of compartment syndrome was based upon clinical symptoms and confirmed by persistently elevated intracompartmental pressures after exercise in every case. The affected compartments were surgically decompressed using small skin incisions and subcutaneous release of the fascia with a Smellie knife.

A total of 103 compartments underwent decompression (70% anterior, 18% lateral, 10% deep posterior, and 2% superficial posterior). Anterior compartment decompression was successful in almost 90% of cases, while decompression of one or more of the

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other compartments had less successful overall results. Indeed, eight patients denied having any benefit from the surgical decompression. Micheli and colleagues conclude that teenage female athletes are perhaps more susceptible to chronic lower extremity compartment syndromes than are men. They also identify the fact, in this study as well as others, that females seem to respond less well to surgical decompression.

COMMENT BY JAMES D. HECKMAN, MD

This is an interesting retrospective review of a large sports medicine practice in a children's hospital. Micheli et al identify some changing trends as the level of suspicion for the diagnosis of compartment syndrome increases. Between 1980 and 1989, Micheli only performed eight fasciotomies, but between 1990 and 1997 he treated 45 patients for the same problem. A high proportion of his surgical patients were women, and the percentage of women with this problem seems to have increased fairly dramatically over the last decade or so. Concurrent with the increased problems in women has been a decline in the overall success rate of fasciotomy for chronic compartment syndrome. Other authors also have found a higher success rate in treating men than in treating women with this problem.[1]

this group of ten patients because that might give us a clearer idea of what the right indications would be for surgical decompression. As with any emerging concept, the frequency of diagnosis increases rapidly once the information becomes available. We perhaps are experiencing a peak of the curve in which too many diagnoses of chronic compartment syndrome, particularly in females, have been made. We now need to back off a little bit and become more rigorous in the specific definition of this condition and more selective in our surgical cases so that fasciotomy will be successful in an extremely high percentage of patients in the future. ❖

Reference

1. Schepsis AA, et al. Surgical management of exertion compartment syndromes of the lower leg. *Am J Sports Med* 1993;21:811-817.

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Case Records of the Massachusetts General Hospital: Dementia Pugilistica

ABSTRACT & COMMENTARY

Synopsis: *The dementia typically seen in fighters is contrasted to other disorders, such as Alzheimer's disease and Parkinsonism.*

Source: Drachman DA (reviewer), Scully RE (ed). Case records of the Massachusetts General Hospital. Weekly clinicopathological exercises. Case 12-1999. A 67-year-old man with three years of dementia. *N Engl J Med* 1999; 340:1269-1277.

The weekly clinical pathological exercise in this issue of the *New England Journal of Medicine* focuses on a case of dementia occurring in a 67-year-old man whose cognitive function began to decline three years prior to presentation at the Massachusetts General Hospital (MGH). One year later, he was diagnosed as having progressive dementia with Parkinsonism. Two months before his admission, he became agitated and was staring off into space and not responding to his surroundings. He fell several times and apparently lost consciousness. One week before admission, he became very irritable, punched his wife, and struck his teenage grandson without provocation.

The past medical history was significant, as the patient had boxed professionally for more than 10 years in more than 100 bouts. Indeed, in one fight he was knocked down

13 times. After retiring from fighting, he functioned well for almost 40 years with no sign of a neurological disease or dementia.

In his review, Drachman outlined an extensive differential diagnosis of dementia and concluded that this patient's clinical picture was most consistent with the diagnosis of dementia pugilistica, even though there was a long period of normal functioning after his retirement. He points out that up to 87% of professional boxers develop some type of neurological impairment, 17% have clinically important neurological deficits, and about 6% have severe dementia, particularly frequent in those who have boxed in more than a dozen bouts. The patient died suddenly of an aspiration pneumonia while hospitalized. The anatomic pathology was characterized by extensive neurofibrillary degeneration of the nuclei in the brain stem, the cerebellum, and the cerebral hemispheres. Extensive changes in the frontal and temporal lobes characterized by neurofibrillary changes point to the anatomic diagnosis of dementia pugilistica.

COMMENT BY JAMES D. HECKMAN, MD

The case records of the MGH always provide interesting and challenging clinical cases. The discussion of this particular case provides a nice overview of the dementias and their differential diagnosis. Drachman contrasts the dementia typically seen in fighters to other disorders, such as Alzheimer's disease and Parkinsonism. Several interesting references are cited, which describe the long-term effects of repeated boxing exposure. ❖

Pump Up Your Walk

ABSTRACT & COMMENTARY

Synopsis: *All walking adjuncts are effective but the increase in heart rate, O_2 consumption, and caloric expenditure is greatest with walking poles and aerobelts.*

Source: Porcari JP. *ACSM's Health and Fitness Journal* 1999; 3(1):25-30.

This is an excellent review of walking adjuncts—that is, those appliances such as walking poles, ankle weights, wrist weights (1-3 lbs), and aerobelts that are designed to increase the intensity of a walking workout either by adding external weight or by increasing the involvement of the upper extremities. Porcari not only describes the equipment (providing cost data and supply sources) but also presents his recent research findings on the average increase in heart rate, O_2 consumption, and caloric expenditure for each of these devices. According to his data, all devices are effective, but the increase in heart rate, O_2 consumption, and caloric expenditure is greatest with walking poles and aerobelts.

An additional advantage to the aerobelts is that the resistance cords retract into a belt worn about the waist; therefore, they can be intermittently added to a walking workout to simulate interval training. The belts come with various levels of resistance tubing so the intensity of the workout can be increased over time. However, both belts and poles are more expensive than wrist or ankle weights. The average cost of weights is $7; of poles, $60; and of aerobelts, $50-$75.

COMMENT BY LETHA Y. GRIFFIN, MD, PhD

Walking, if the joints of the lower extremities are free of significant arthritis or other limiting musculoskeletal problems, is an excellent aerobic activity that requires access only to a walking area and a good pair of walking shoes. One can walk with friends or alone. No court schedule or gym availability is required. However, patients often express that they don't feel walking gives them a "good enough workout." They wish to increase their workout heart rate, burning a greater number of calories per unit of time. The walking adjuncts Porcari discusses allow patients to increase heart rate, O_2 consumption, and caloric expenditure with relative safety. One should caution patients, however, not to increase leg or arm weights beyond 2-3 pounds, as increased weight translates to potential harmful stresses on the joints of the low back and extremities. Increasing the resistance of aerobelts should be done slowly over time, and arm weights should not be swung overhead but should be kept below 90° to minimize shoulder overuse problems. ❖

Tennis After Total Hip Arthroplasty

ABSTRACT & COMMENTARY

Synopsis: *Return to playing tennis is an attainable goal after total hip arthroplasty. However, it does present a risk for early implant failure.*

Source: Mont MA, et al. Tennis after total hip arthroplasty. *Am J Sports Med* 1999;27:60-64.

Mont and colleagues characterized the functional results related to the return to playing tennis after total hip arthroplasty. They studied hip arthroplasty patients who returned to playing tennis after their opera-

tion, recording functional outcome measures and patient satisfaction. They found that all of their patients were extremely satisfied with their functional results, and they were all happy to resume playing tennis. These patients were playing both singles and doubles tennis approximately three times per week. There were, however, three patients (3/58) who did require revision surgery eight years later. Therefore, Mont et al offer caution and close follow-up of patients who do resume such high-impact activities.

COMMENT BY STEPHEN B. GUNTHER, MD

Impact-loading activities present a theoretical risk for loosening and wear-related osteolysis in total joint arthroplasties. This study specifically addresses functional outcome measures related to total hip arthroplasty. Tennis is an impact activity that does pose a risk of wear-related complications, including osteolysis and implant failure.[1] However, all patients in this study were satisfied with their surgical result, including the patients who eventually required revision surgery. Therefore, the functional results were excellent, even in patients who could be classified as clinical failures.

Ultimately, it is the patient who must weigh the risks and benefits of resuming potentially harmful activities. Impact-loading sports increase the risk of implant failure, but this may be a worthwhile risk for many patients. The role of the orthopedic surgeon, therefore, is to properly advise these patients. Further outcome studies recording clinical as well as functional results in longer-term follow-up of larger numbers of patients will assist both patients and surgeons in this role. ❖

Reference

1. Kilgus DJ, et al. Patient activity, sports participation, and impact loading on the durability of cemented total hip replacements. *Clin Orthop* 1991;269:25-31.

Examining the Rotator Cuff: Is the Can Empty or Full?

ABSTRACT & COMMENTARY

Synopsis: *Muscle weakness should be used as the key to interpreting the "empty can" and "full can" examination tests for torn supraspinatous tendons.*

Source: Itoi E, et al. Which is more useful, the "full can test" or the "empty can test," in detecting the torn supraspinatous tendon? *Am J Sports Med* 1999;27:65-68.

Itoi and colleauges sought to better define the physical examination tests used to evaluate tears of the supraspinatous muscle-tendon complex. Under consideration were the "empty can" and "full can" tests. The first involves placing the shoulder in 90° abduction in the scapular plane and then requesting full internal rotation, as would be seen with the emptying of a can. The second is a newer test,[1] involving placement of the shoulder in 90° abduction in the scapular plane and then requesting 45° external rotation, as with the holding of a full can. Two questions were addressed in this study: 1) should the physician use pain, weakness, or both as an indicator of a positive test for supraspinatous tear, and 2) which test is more clinically useful for the detection of a supraspinatous tear?

One hundred forty-three shoulders from patients of all ages (range, 13-80 years) comprised the study population. Subjects were questioned regarding pain with the provocative maneuvers and were graded on a six-point strength scale (5-0) such as is used for motor assessment during a neurologic examination. All patients then underwent high-resolution magnetic resonance imaging (MRI) of the shoulder that served as the gold standard for presence or absence of disease—although Itoi et al admitted that such imaging is only 95% accurate for detection of full-thickness tears of the rotator cuff. There were 35 full-thickness tears found in the rotator cuff; 19 in the supraspinatous area alone, and the other 16 involved that muscle and at least one other. Not surprisingly, defining a positive test as the presence of pain, weakness, or both yielded the highest sensitivity (empty can 89%, full can 86%). Muscle weakness proved to be the most specific indicator of a tear (empty can 68%, full can 74%), and also yielded the highest diagnostic accuracy. Itoi et al concluded that muscle weakness should be used as the key to interpreting the two tests. Accepting this, the two tests were found not to differ significantly with regard to specificity and accuracy. Itoi et al hypothesize that the full can test may be more beneficial in the clinical setting because it causes less pain; given that the tests are equivalently accurate, the less painful test would be more desirable.

COMMENT BY RICHARD A. HARRIGAN, MD, FACEP

The can tests, full and empty, are a means to detect occult tears of the supraspinatous tendon. Acute tears may be suspected by history, but the more common chronic tears can be difficult to detect in that an antecedent event is often not recalled. Certainly the "drop arm test"[2] is fairly good for the detection of significant tears; if the patient cannot slowly range his or her arm from 90° abduction to 0° or cannot maintain 90° abduction despite the examiner's gentle downward

tap of the abducted arm, it seems intuitive that a tear exists. The drop arm test is more an all-or-nothing test, whereas a positive test in this study was defined as any muscle weakness detected during these maneuvers. It makes sense not to use pain as evidence of a full-thickness tear, in that pain during the empty can test may be representative of simple impingement, as is seen with rotator cuff tendonitis. As Itoi et al point out in their discussion, pain may negatively influence the assessment of weakness. The empty can test, while no doubt sensitive for impingement, may be flawed as an indicator of a tear, in that pain may mimic weakness during provocative testing. ❖

References

1. Kelly BT, et al. The manual muscle examination for rotator cuff strength. An electromyographic investigation. *Am J Sports Med* 1996;24:581-588.
2. Hoppenfeld S. *Physical Examination of the Spine and Extremities*. Norwalk, CT: Appleton and Lange; 1976: 33.

Long-Term Effects of Complete Meniscectomy for a Discoid Lateral Meniscus

ABSTRACT & COMMENTARY

Synopsis: *Complete meniscectomy for a discoid lateral meniscus leads to eventual arthrosis in most cases.*

Source: Raber DA, et al. Discoid lateral meniscus in children. Long-term follow-up after total meniscectomy. *J Bone Joint Surg Am* 1998;80(11):1579-1586.

In approximately 1% to 17% of individuals, the lateral meniscus is discoid, with the central portion filled as opposed to the normal "C" shape. This discoid meniscus can be symptomatic, especially if the posterior meniscotibial attachment is not present. Patients usually present as children or adolescents, complaining of painful snapping on knee flexion and decreased ability to extend the affected knee.

Prior to the advent of arthroscopy, and even today for some unstable discoid menisci, treatment involved complete, open lateral meniscectomy. Raber and colleagues retrospectively evaluated 17 knees at a mean of almost 20 years following total meniscectomy. Four of the 17 were abnormal or severely abnormal using the International Knee Documentation Committee (IKDC) clinical rating system. Ten of 11 knees that were x-rayed showed radiographic changes of osteoarthrosis, although only four were moderately or severely painful with daily activities. Eight knees had also developed ligamentous instability. In total, only seven of 17 operatively treated knees were clinically normal and without subjective or objective symptoms over the long term.

COMMENT BY DAVID R. DIDUCH, MS, MD

A symptomatic discoid lateral meniscus is ideally treated by arthroscopic partial lateral meniscectomy, saucerization, or removal of the central portion so that the meniscus more closely resembles a normal "C" shape. Accomplishing this objective can be technically difficult due to the thickness of the tissue and obscured visualization at surgery. Discoid menisci without a posterior attachment (Wrisberg type) are frequently excised to avoid leaving an unstable rim. Successful repairs have been reported, but they have been restricted to case reports or small series of cases, as healing is difficult to achieve in an area that had no attachment to begin with.

The most significant finding by Raber et al was the high incidence of arthrotic changes found on x-ray. Other studies have noted a generally lower rate of arthrosis, ranging from 5% to 70%, but those studies were generally over a shorter term. The literature does tend to report greater arthrotic changes with studies having longer follow-up, as would be expected.[1-3] Even though only four of 17 knees in this study were moderately or severely symptomatic, it is expected the clinical symptomatology will follow the observed x-ray changes with time.

This study effectively demonstrates that complete meniscectomy for a discoid lateral meniscus leads to eventual arthrosis in most cases. As such, total meniscectomy should be avoided whenever possible, being reserved only for those cases in which partial meniscectomy would leave an unstable posterior rim that is not amenable to repair. ❖

References

1. Aichroth PM, et al. Congenital discoid lateral meniscus in children. *J Bone Joint Surg Br* 1991;73(6):932-936.
2. Washington ER, et al. Discoid lateral meniscus in children. *J Bone Joint Surg Am* 1995;77(9):1357-1361.
3. Wroble RR, et al. Meniscectomy in children and adolescents. *Clin Orthop* 1992;279:180-189.

Reliability and Responsiveness of

Disablement Measures Following Acute Ankle Sprains Among Athletes

ABSTRACT & COMMENTARY

Synopsis: *Some typical clinical measures are sensitive to change during rehabilitation following ankle sprains in athletes.*

Source: Wilson RW, et al. Reliability and responsiveness of disablement measures following acute ankle sprains among athletes. *J Orthop Sports Phys Ther* 1998; 27(5):348-355.

In this study, selected, commonly used measures of impairment are evaluated in a group of athletes with ankle sprains to determine their reliability. Wilson and associates used a "prospective multivariate within subjects design" to observe the "stability and responsiveness of clinical measures during the early clinical rehabilitation period following acute ankle sprain." Twenty-four consecutive athletes who presented with grade 1 or grade 2 ankle sprains volunteered for the study. However, because of lack of adherence to protocol, this number dwindled to 13. All were male. The following measures were taken at day 3 and at day 10: joint swelling using a volumetric measurement, dorsiflexion and plantar flexion range of motion, and motor activity. Motor activity was measured using the following: (1) 40-meter walk; (2) 40-meter run; (3) figure-of-8 run; (4) single hop; (5) cross-over hop; and (6) self-reported athletic activity assessed on an analog scale. Data analysis was done using "distribution free statistics." Reliability was determined for all measures as follows: "intra-occasion tests/re-test reliability coefficients and standard errors of measurements were calculated from univariate repeated-measures ANOVAs."

All measures were compared to each other and compared at day 3 and day 10. Results indicated that the motor activity score had an internal consistency of 0.90. Therefore, a motor activity score was computed by summing the individual task scores for each subject. Within-group changes were detected both in swelling and motor activity; however, range-of-motion changes were not sensitive to change.

COMMENT BY CLAYTON F. HOLMES, EDD, PT, ATC

The findings of this study indicate that some typical clinical measures are sensitive to change during rehabilitation following ankle sprain in athletes. It should be pointed out that a major weakness of this study is that Wilson et al did not determine inter-rater reliability of any of these measures before beginning this study. This should be done by the individuals who will perform the measurements before any study is undertaken. It is important to note that they found that so-called "objective" measures may not be any more reliable than "subjective" measures. As a matter of fact, this study shows that "simple motor performance and self-reported measures employed three days post injury were as responsive to change as highly reliable impairment measures such as volumetric displacement." This finding is consistent with other studies regarding self-reported measures, particularly in athletes, and seems to indicate that these subjective measures are at least as important as "objective" measures. Finally, it is encouraging to know that some of the measures taken on a daily basis in rehabilitation environments are sensitive enough to determine change despite a lack of emphasis on these measures in the current health care environment. ❖

On-Field Examination and Care: An Emergency Checklist

ABSTRACT & COMMENTARY

Synopsis: *A review of the basics of emergency evaluation and care of the conscious and unconscious athlete.*

Source: Stuart MJ. *Physician and Sportsmedicine* 1998; 26(11):51-55.

Stuart provides an excellent, quick review of basic principles of emergency evaluation and care of the conscious and unconscious athlete and reminds us of the importance of adequate planning and preparation for emergencies, including establishing and practicing protocols and developing a mental checklist for assessing severe injuries. The latter should include ensuring an adequate airway, breathing, and circulation (the ABCs); determining the level of consciousness and mental status; and a quick assessment for additional injuries while summoning emergency transport personnel. Remember that all unconscious athletes should be treated as if they have a cervical spine injury.

COMMENT BY LETHA Y. GRIFFIN, MD, PhD

The NCAA Committee on Competitive Safeguards and Medical Aspects of Sport recently encouraged member institutions to review emergency coverage at all sporting

events, particularly emphasizing the need to designate a "responsible person" knowledgeable in first aid and CPR to cover out-of-season sport practices and skill instruction sessions where traditional medical coverage is not typically available. This individual should have immediate phone access for summoning additional help as well as a clear understanding of the procedures to follow if an emergency situation occurs.

Often physicians are asked to cover an athletic event at the last minute, and they arrive on the scene lacking equipment needed to remove athletic gear that could impede emergency evaluation and treatment (for example, tape shears to remove athletic tape and cutters to remove face masks on football helmets). Often they are without full knowledge of available emergency equipment, phone accessibility, and potential paths for evacuation of an acutely injured athlete (for example, can an ambulance access the sporting field?). It behooves us to always consider these essentials when covering an event and to make certain all is ready if an emergency should arise. Forgetting to check on such essentials may result in a preventable tragedy. ❖

Symptomatic Thrower's Exostosis

ABSTRACT & COMMENTARY

Synopsis: *Patients with larger posterior osteophytes were more likely to have poor results on an arthroscopic evaluation.*

Source: Meister K, et al. Symptomatic thrower's exostosis. Arthroscopic evaluation and treatment. *Am J Sports Med* 1999;27(2):133-136.

Meister and colleagues described a lesion of the posterior glenoid, a moderately sized osteophyte, that has been found in symptomatic overhead athletes. These athletes experienced pain during cocking, acceleration, and the follow-through phases of throwing. They all underwent arthroscopic evaluation. Fifteen were found to have a tear of the posterior labrum, four had fraying of the anterior labrum, and 21 had partial tears of the undersurface of the rotator cuff as well as the osteophyte. A debridement of the cuff and labral lesions was followed by resection of the posterior osteophyte in 11 of these patients. Follow-up evaluation revealed that approximately 55% had returned to their premorbid level of throwing, remained asymptomatic, and maintained a high level of performance for a mean of 3.6 years. Five of these players are still participating at the major league level, and five had retired at the latest follow-up. There was only one recurrence of the exostosis. Meister et al believe that patients with larger posterior osteophytes were more likely to have a poor result.

COMMENT BY JAMES P. TASTO, MD

Posterior shoulder pain has been recognized in the throwing athlete as a difficult problem over the years, and a number of potential causes have been identified. There have been other reports of capsular caldification and posterior osteophytes; their etiology as well as their treatment and results of treatment have remained quite varied. A number of causes of the development of the thrower's exostosis have also been described by a number of authors, and their etiology remains controversial. A number of etiologies have been set forth, including repetitive traction on the posterior capsule and triceps traction on the posterior inferior aspect of the glenoid. Other authors, however, feel that the triceps is not associated with this exostosis. Some investigators postulate that the osteophyte is a direct result of "internal impingement"—direct compression of the posterior glenoid in the cocking phase of throwing.

It is important to attempt to define the etiology of posterior shoulder pain in the overhead athlete. Mild overuse syndrome, caused by such things as teres minor tendinitis and mild posterior capsulitis, should be ruled out. When the posterior pain does not respond to conservative care, further workup is indicated, which may eventually result in arthroscopic surgery. Findings on physical examination usually include tenderness about the posterior and inferior glenoids. CT arthrography and plain CT scans are quite helpful. Plain x-rays, including Bennett and Stryker notch views, can also be helpful in defining the posterior glenoid exostosis. ❖

CME Questions

31. Which of the following lesions is usually not described with the posterior glenoid exostosis?
a. Anterior labral tearing or fraying
b. Tears of the posterior labrum
c. Undersurface tears of the rotator cuff
d. Biceps tendon tears

32. Severe dementia occurs in what percent of former professional boxers?
a. 1%.
b. 6%.
c. 15%.
d. 33%.

33. Surgical decompression of chronic compartment syndrome in teenage female athletes is most likely to be successful in which compartment?
a. Anterior

b. Lateral
c. Posterior
d. Superficial posterior

34. Safe walking adjuncts to effectively increase your O_2 consumption, heart rate, and caloric expenditure while walking include:
a. walking poles, 10- to 20-lb ankle weights, and aerobelts.
b. walking poles, aerobelts, and 2-lb arm weights.
c. 10- to 20-lb ankle weights, weighted vests, and aerobelts.
d. weighted shoes, aerobelts, and walking poles.

35. All of the following activities pose an increased risk for total joint implant wear disease *except*:
a. volleyball.
b. rugby.
c. tennis.
d. shuffleboard.
e. wrestling.

36. Which of the following measures are sensitive to change during post-ankle-sprain rehabilitation?
a. Motor performance measures
b. Self-reported functional measures
c. Volumetric displacement
d. a and b only
e. a, b, and c

37. Emergency assessment of the injured athlete should include the following:
a. ensuring an airway and breathing.
b. circulation status.
c. level of consciousness check.
d. All of the above

38. The treatment of symptomatic discoid lateral meniscus by total meniscectomy results in:
a. complete recovery.
b. arthrosis of the lateral compartment.
c. regeneration of a healthy meniscus.
d. instability symptoms in most patients.

39. The "full can test"
a. is generally more painful than the "empty can test."
b. may indicate a tear in the coracoclavicular ligament.
c. may be more beneficial clinically in assessing tears of the supraspinatous ligament than the "empty can test."
d. is positive only in acute rotator cuff tears.

In Future Issues:

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