

# Median and common peroneal neuropathy in coir workers of Alappuzha district, Kerala

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## Abstract

**Introduction:** Coir work, in a large number of people involves mechanically rolling the coconut fibers into coir which is later subjected to various processes. The primary work is done as a cottage industry specially by women in the sitting posture for several hours. This study reports evidence of median and common peroneal neuropathy electrophysiologically in people who had been engaged in this job for several years. This study was initiated to establish the possible relationship between coir work and symptomatic neuropathies which was seen in that region with all investigations "for other causes not" contributing to the etiological diagnosis. **Subjects and Methods:** One hundred and forty-two upper limbs and 142 lower limbs in patients engaged in long years of coir work but having no symptoms were evaluated electrophysiologically with informed consent and financial compensation, appropriate inclusion and exclusion criteria were followed as described in the text. **Results:** There is electrophysiological evidence for median and common peroneal neuropathy in persons engaged in long years of coir work. **Conclusions:** Coir workers neuropathy appears to be a new occupational neuropathy which can be prevented by following simple preventive measures.

## Key Words

Coir work, entrapment neuropathy, median nerve, superficial peroneal nerve

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## Introduction

Entrapment neuropathies are a group of peripheral nerve disorders caused by restriction or mechanical distortion of a nerve within a fibrous or fibro-osseous tunnel or by bones, ligaments, vessels, connective tissues, or mass lesions. This condition was described by Sir Astley Cooper in 1820, Paget in 1850, and first surgery was done by Learmonth in 1930. Compression, angulation, and stretching are important mechanisms which produce injury at certain vulnerable sites.<sup>[1]</sup> It is important to recognize these group of disorders as there is a possibility of both prevention and surgical treatment if confirmed. In certain occupations such as using musical instruments, computers, hypothyroidism, diabetes mellitus, rheumatoid arthritis, acromegaly, pregnancy, collagen vascular diseases, tumors such as ganglion, hemangioma, lipoma, schwannoma, neurofibroma, infections such as sarcoid, septic

arthritis, lyme disease, tuberculosis and congenital small carpal tunnel, anomalous muscles, and persistent median artery. Harvesting practices in North India produce traction on the common peroneal nerve at the neck of the fibula as farmers kneel to reap the crop with the sickle.<sup>[2,3]</sup> Ulnar nerve entrapment in the cubital tunnel at the elbow is demonstrated in diamond workers in Mumbai and Gujarat.<sup>[4,5]</sup> Entrapment neuropathies account for 10–20% of surgical procedures in peripheral nerves.<sup>[6]</sup> The exact signs and symptoms depend on the nerve involved starting with irritative sensory features such as pain and paresthesia followed by numbness then wasting and weakness. The major mixed nerves also show features of reflex sympathetic dystrophy such as dry skin, cracked nails,

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ulcerations, and hair loss. This condition was described by Sir Astley Cooper in 1820, Paget in 1850, and first surgery was done by Learmonth in 1930. Focal demyelination, Wallerian degeneration, endoneurial swelling, collagen proliferation, and thickening of perineural sheath and secondary axonopathy, and ischemia due to chronic compression are reported as the underlying pathomechanisms. Electrophysiologically, short segment conduction delay or conduction block across the site of entrapment are seen. Wallerian degeneration gives rise to denervation of the affected muscles. Nerve conduction and electromyography are essential for documentation of the site and severity of the entrapment. Myelin has a symbiotic relationship to axon and the gaps in between myelin have high sodium channels. When compressed, there is segmental demyelination and axonal degeneration. Fusiform swelling develops called as Morton's neuroma. Mucopolysaccharides deposition in the accompanying vessel happens which is called as perineurinoma. There is dislocation of the nodes of Ranvier and outgrowth from the distal strips called as Bungler bands. When a nerve is compressed at one site, it becomes more vulnerable to compression elsewhere which is termed as double crush.<sup>[7]</sup> Persons with hereditary neuropathies with tendency for pressure palsy develop paralysis with trivial pressure trivial pressure and median nerve entrapment at the wrist.<sup>[8]</sup>

Median nerve enters the wrist through the carpal tunnel whose roof is formed by a thick transverse ligament and the sides by carpal bones. Nine flexor tendons traverse the canal, in addition to the nerve. In the palm, the nerve divides into motor and sensory division to supply the first and the second lumbricals, and recurrent thenar branch to the muscles of thenar region including flexor pollicis brevis. Sensory branch supplies the medial part of the thumb, index finger, middle finger, and lateral part of the ring finger. When there is compression, patient presents with pain in the hand in the above distribution as well as proximally with relief on shaking or hanging the hand. There is exaggeration of symptoms with flexion of wrists called as Phalen's test or with extension called reverse Phalen's test. As the disease advances, there is complete failure of thumb abduction and severe atrophy of the abductor Pollicis Brevis causing a boat-shaped depression in the thenar region. Electrophysiology can be normal in 10–25%; therefore, comparison between median and ulnar, wrist to the 4<sup>th</sup> digit sensory latency, median second lumbricals versus ulnar interossei distal motor latency (DML), median versus radial wrist to thenar, nerve conduction velocity while inching across the wrist in addition to electromyography of the thenar muscle are indicated in symptomatic patients.<sup>[9]</sup>

Treatment consists of removal of the offending agent, anti-inflammatory drugs, and steroids and surgery by endoscope or mini-open method. Neurolysis is indicated when there are neuroma and causalgia in the presence of severe motor impairment.<sup>[10]</sup>

#### Common peroneal nerve entrapment

This is commonly seen in males at the neck of the fibula. It has a superficial and deep branch. Superficial branch has sensory supply to the lower two-third of the lateral part of the leg and dorsum of the foot and motor branch supply to peroneus longus and brevis. The deep branch supplies tibialis anterior extensor hallucis, extensor digitorum longus, and brevis as well as peroneus tertius. The sensory supply is to the first

webspace. When affected there is foot drop with weakness of eversion and numbness of the lower lateral leg and dorsum. Angle jerk remains unaffected.

#### Study design and rationale

It was casually observed there was an unusually high number of patients presenting with carpal tunnel as well as lateral popliteal nerve palsy in persons of all age groups for which no definite cause could be identified and on questioning, it was found that converting coconut fibers into coir was the common cottage industry of that place. Therefore, it was decided to study the asymptomatic persons of that place engaged in coir work and look for electrophysiological evidence for entrapment neuropathies of the median nerve and lateral popliteal nerve. The study period is from 1993 July to December 1993 in Alappuzha, Kerala, South India.

Coir work involves prolonged sitting in the floor with one leg flexed and other leg extended in an alternating posture for several hours. Then, they hold the coconut fiber in the left palm and rub it to make the thread with the right palm. This work is done mainly by females who usually start their work by the end of their first decade [Figures 1 and 2]. There is in addition exposure to dyes and chemicals.

#### Subjects and Methods

Seventy-one asymptomatic individuals equivalent to 142 upper limbs and lower limbs belonging to the age group 17–60 years and doing coir work for varying periods of time from 6–30 years were included in the study. The exclusion criteria were the presence of other diseases associated with peripheral neuropathy, exposure to drugs, toxins including exposure to dyes used in coir work and those who satisfied criteria were brought to the Institute Government Tirumala Devaswom Medical College, Alappuzha after informed consent. They underwent thorough neurological examination and studies were done to rule out diabetes mellitus, hypothyroidism, and rheumatoid arthritis. Persons were grouped into two groups based on the duration of coir work, those who had been doing coir work for < 10 years and those who had been doing for more than 10 years. Then, they were submitted for electrophysiological study using Dantec Neuromatic 2000 machine using the criteria as per Wilbourn and Aminoff clubbed with institutional normative data.<sup>[11]</sup>



Figure 1: Posture adopted by persons during coir work

Nerve conduction studies were done for the median, ulnar, lateral popliteal, and sural nerves using standard protocol. Inching studies, wrist to digit and palm to digit comparisons, and F latencies were not done. Digit 4 median versus ulnar sensory were done only in few cases. The aim was to demonstrate focal slowing or conduction block of median nerve fibers across the carpal tunnel and common peroneal nerve at the neck of the fibula. Criteria for abnormality considered as per the following criteria. Median DML from wrist to abductor pollicis brevis muscle of >4.2 m/s. Orthodromic sensory conduction velocity along the second digit to wrist segment of <45 m/s, amplitude <7  $\mu$ v. Orthodromic median minus ulnar palmar velocity comparison of more than 11 m/s and absence of abnormalities suggestive of another diagnosis. Any person who showed abnormality in sensory conduction, motor conduction, or both as per the inclusion criteria were counted as abnormal. Those who showed median distal latency more than 4.5 m/s and common peroneal more than

5.5 m/s and velocity <35 m/s were considered as having severe delay [Figures 3-7,8a and b].

**Observations**

There were a total of 71 persons and 142 upper and lower limbs, all persons were females. Their age group varied from 15 to 60 years. There were seven persons in the 15–30 years age group and 29 in the 31–45 years age group, 35 in the 46–60 year age group. In the 15–30 years age group, 50% of persons had one or both median nerve involvement and 70% had lateral popliteal nerve involvement (out of 14 upper limbs, seven had involvement, right four and left three of which two had bilateral signs); out of 14 lower limbs, there were ten abnormal, five right and five left of which three had bilateral signs. In the 31–45 years age group, 78.1% had median nerve (45 limbs, 29 right and 16 left and bilateral in ten among this) and 44.4% had lateral popliteal nerve involvement (25 limbs, right 12, left 13 and bilateral in seven). In the 46 and above age group, 63.4% (45 median nerves, 34 right, 11 left and nine among this bilateral) and 35.3% (24 limbs, 13 right, 11 left and bilateral among these in seven) had lateral popliteal involvement. None of the persons had evidence of peripheral neuropathy or mononeuritis of ulnar, radial, or sural nerves. Thirty-six persons (50.7%) had been

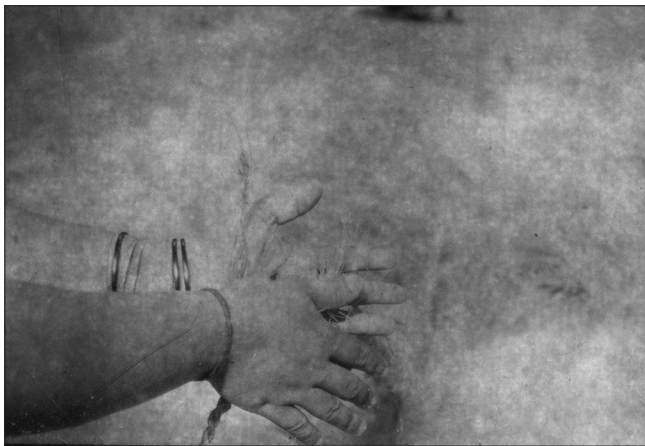


Figure 2: Position of hands

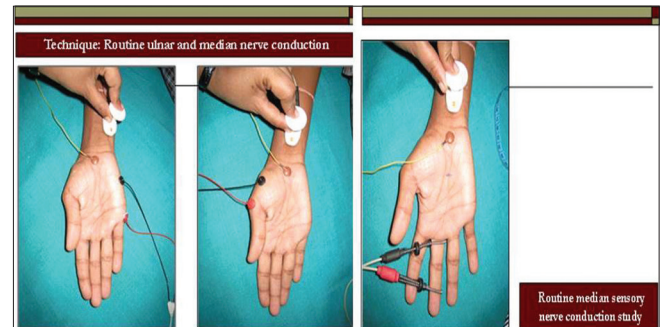


Figure 3: Techniques of electrophysiological study

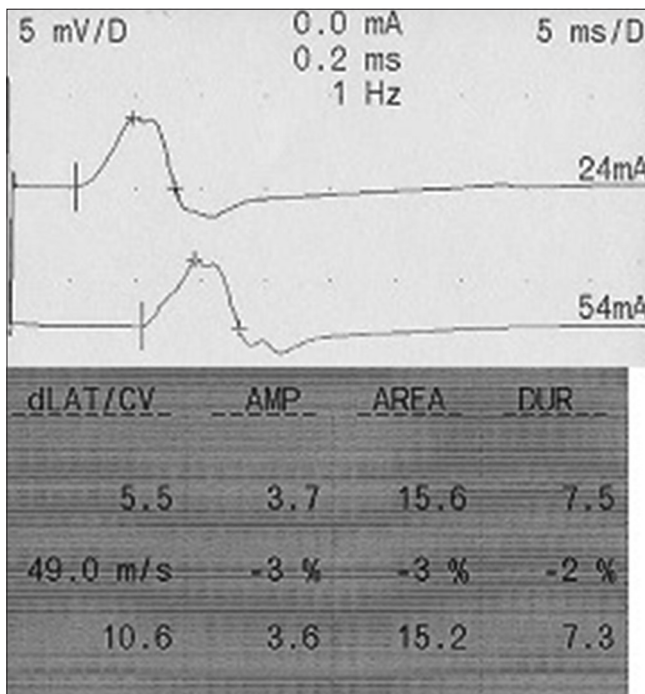


Figure 4: Abnormal left median motor conduction

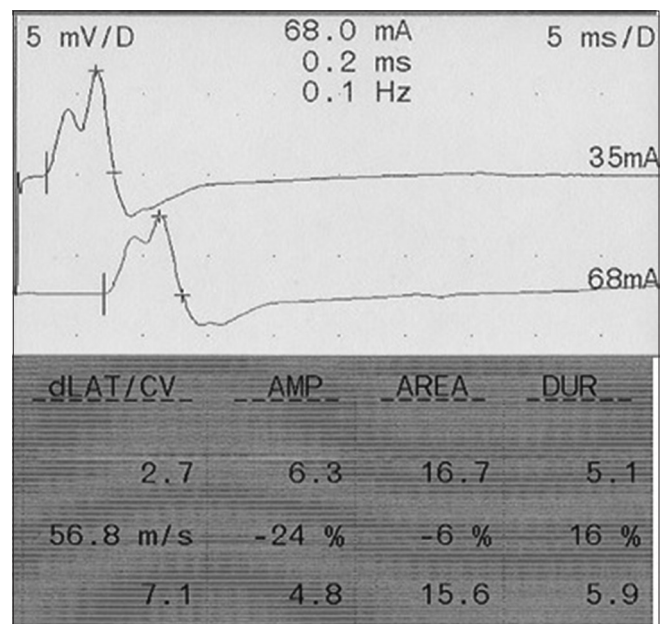


Figure 5: Normal left ulnar motor conduction

doing coir work for <10 years and 35 persons (49.3%) had been doing coir work for more than 10 years. Median nerve involvement was most commonly seen in persons in the age group between 31 and 45 years. Whereas lateral popliteal nerve showed maximum involvement in persons between 15 and 30 and 46 years and above age groups. In patients who had been doing coir work for more than 10 years, delayed median nerve conduction velocity in either motor or sensory was seen in 55.7%, which was mild in 15.7% and severe in 40%. 64.2% had evidence for lateral popliteal nerve involvement, which was severe in 43.7% and mild in 20.5%. Chi-square test for median and lateral popliteal nerve was done and it was significant with reference to common peroneal nerve with longer duration of coir work [Table 1].

In the <10 years of coir work group, median nerve involvement was seen in 61.5%. This was mild in 13.5% and moderate in 48%. Lateral popliteal nerve involvement was seen in 28.8%, it was mild in 17.6% and moderate in 11.2%. Comparing the >10 year group and < 10 year group, median neuropathy did not show any significant difference. However, common peroneal neuropathy showed a slight increase in patients belonging to the more than 10 year group [Figures 9 and 10, Tables 2 and 3].

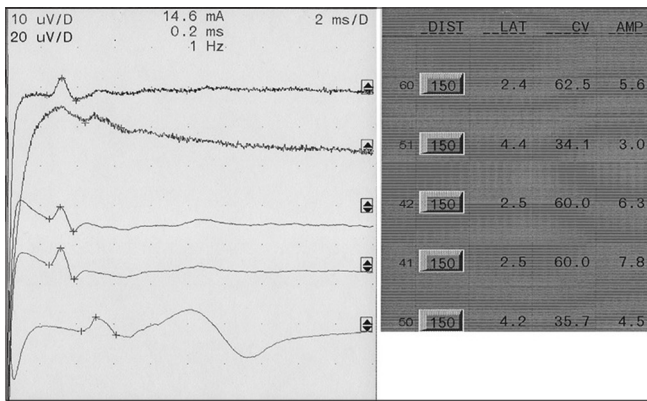
**Discussion**

Asymptomatic coir workers of all age group from 15 to 60 years who had been doing coir work from 6 to 30 years duration and grouped into less than and more than 10 year

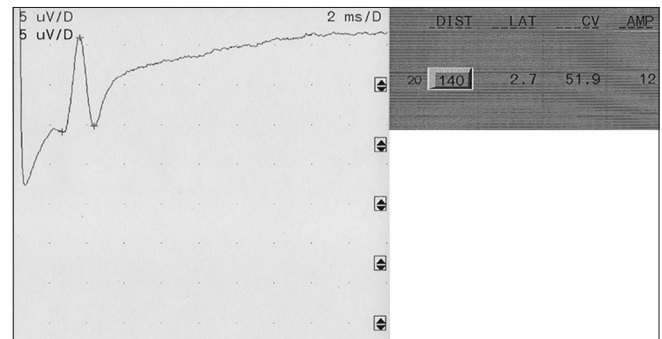
group, showed evidence of mild to moderate or severe delay in motor, sensory, or both conduction abnormalities. In the < 10 year group, the lateral popliteal nerve conduction delay was seen in a very small percentage compared to median nerve conduction changes. In the persons with more than 10 year group, both lateral popliteal and median nerve showed abnormality. The peak age group which showed maximum median nerve abnormality is 31–45 year age group. This correlates with the maximum hours of coir work done per day. Right median nerve showed greater delay than the left in all groups. Lateral popliteal nerve involvement is more commonly seen in patients in the age group between 15–30 years and 46–60 years. It could be due to the longer periods of sitting in the cross-legged position in these groups. In the younger people, it matches with longer hours of sitting and in the older people with longer duration of coir work. However, the numbers are too small in the 15–30 years age group compared to other age groups.

**Table 1: Statistical evaluation based on duration of coir work**

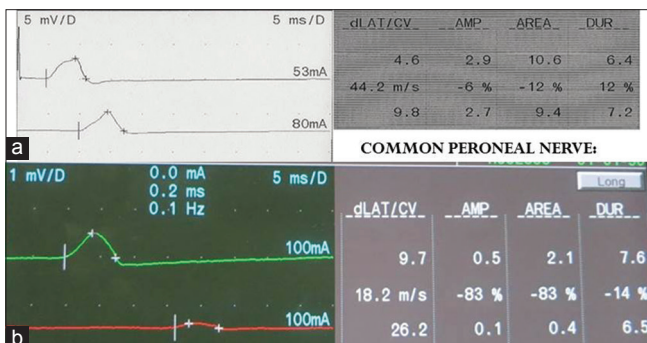
Duration	Median nerve involvement		Total Duration	Lateral popliteal involvement		Total
	Positive n (%)	Negative n (%)		Positive n (%)	Negative n (%)	
<10	22 (61.5)	14 (38.5)	<10	10 (28.8)	26 (71.2)	36
>10	20 (55.7)	15 (44.3)	>10	22 (64.2)	13 (35.8)	35
Total	42+	29	Total	32	39	71



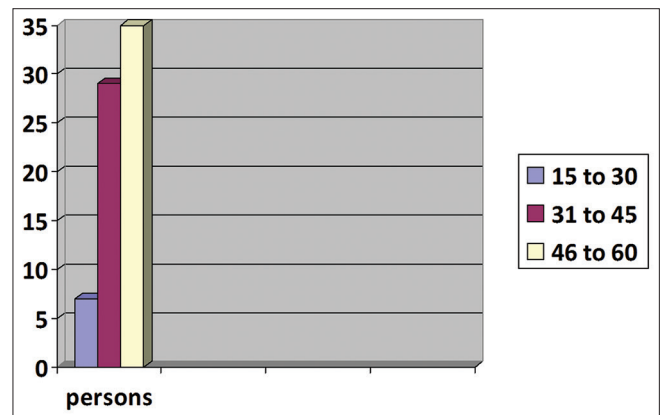
**Figure 6: Median versus ulnar digit 4 sensory latency: First three complexes show digit 2, 3, and 4 median and the last one ulnar digit 4 demonstrating delay**



**Figure 7: Right sural sensory normal**



**Figure 8: Common peroneal nerve: (a) Normal, (b) abnormal**



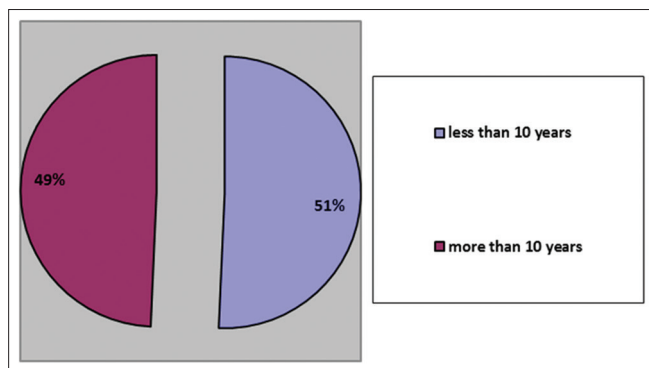
**Figure 9: Age-wise distribution of persons recruited for study**

**Table 2: Age-wise distribution of limbs studied**

Age	Total persons	Upper limbs	Lower limbs
15-60	71	142	142
15-30	7	14	14
31-45	29	58	58
46-60	35	70	70

**Table 3: Age-wise distribution of abnormalities seen**

Age	Median nerve			Common peroneal nerve		
	Right	Left	Both	Right	Left	Both
	Total (7)			Total (7)		
15-30	4	3	2	5	5	3
	Total (45)			Total (25)		
31-45	29	16	10	12	13	7
	Total (45)			Total (24)		
46-60	34	11	9	13	11	7

**Figure 10: Duration of coir work**

## Conclusions

There is electrophysiological evidence of entrapment of the median nerve in the upper limbs and lateral popliteal nerve in the lower limbs in asymptomatic coir workers. This indicates a probable relation between coir work and these neuropathies. Persons with other known causes of peripheral neuropathy and entrapments were not included in the study. Maximum evidence for median nerve conduction abnormality is seen in the 35–45-year-old persons, which indicate this probably correlates with the maximum hours of engagement in the occupation on a day to day basis. Whereas common peroneal nerve involvement shows a higher incidence in the later age group which could be due to years of stretch on the common peroneal nerve. However, 15–30 year age group also showed relatively more involvement of common peroneal nerve compared to 31–45 year age group. Whether this implies daily hours of work with stretch on the common peroneal nerve is not very clear. However, the number in this group is very small, the right median nerve is more involved than the left probably related to the dominance and therefore more use of the right hand. This study also indicates that patients can be asymptomatic even in the presence of a significant electrophysiological abnormality. Persons who had more than 10 years of coir work showed more common peroneal

nerve involvement; however, median nerve involvement was same in both groups.

Recent studies have observed that occupational carpal tunnel syndrome is influenced by age, gender, weight, hand anthropometry, and hand dominance than the occupation itself.<sup>[12]</sup> Magnetic resonance imaging has revolutionized the assessment of entrapment neuropathies.<sup>[13]</sup> Sangwan *et al.* have reported occupational common peroneal nerve entrapment in people who work in the fields.<sup>[14]</sup> These recent evaluation tools have not been utilized in our study as it was conducted in 1993.

## Recommendations

Persons engaged in coir work are recommended to use wrist guard and sit on a raised platform, thus avoiding stretch on these nerves.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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## Announcement

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**Date:** 07-09 July 2017

**Venue:** Le Meridian international Convention Center, Kochi

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**Teaching course (04)**

KAN - INUS Uroneurology teaching course

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