

# Ulnar Nerve F-Wave Response of Normal Sudanese Adults

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## ABSTRACT

**BACKGROUND AND AIM:** Use of F-wave studies is a recent development in electrophysiology. Abnormalities in F-wave latency may be the sole abnormality in certain types of peripheral neuropathy when other conduction studies have been normal. Our work aimed to determine mean values for the principle components of the ulnar nerve F-wave, namely: latency, amplitude, duration in normal Sudanese adults, to compare between right and left, distal and proximal mean values of the F-wave latency, amplitude and duration, and to find out sex and age related changes in the principle components of the F-wave as well as to find a relationship between the different F-wave parameters. **SUBJECT AND METHODS:** Observational nerve conduction study was performed on one hundred normal Sudanese adults (male=55, female=45), on voluntary basis, using an inclusion criteria of being normal Sudanese adult with no history of neurological disease. Recording took place in the faculty of medicine, university of Khartoum, using an electromyography machine. **RESULTS:** Values obtained in this study showed a mean of  $27.6 \pm 0.23$  (SE) msec for F-wave distal latency, a mean of  $433.75 \pm 17.46$  (SE) mV for F-wave distal amplitude and a mean of  $6.27 \pm 0.22$  (SE) msec for F-wave distal duration. No significant difference observed between right and left upper extremities in the different F-wave parameters and between distal and proximal values of the F-wave amplitude and duration. There was sex related changes in F-wave distal latency and duration with shorter latency in females and shorter duration in males, but no age related changes was observed concerning latency, amplitude and duration. A significant correlation between distal and proximal values of the F-wave components as well as between F-latency & duration and between F-amplitude and duration had been suggested. **CONCLUSION:** Mean values of ulnar nerve F-wave components among healthy Sudanese adults seems to similar to universal figures. Right and left and distal and proximal values were similar and no age related changes observed in the different F-wave parameters. F-wave latency revealed a significant relationship with sex, F-wave duration was more related to F-latency than to sex, with shorter latency in female and shorter duration in males. A strong positive correlation between distal and proximal values and between distal amplitude and duration was also suggested, while a negative correlation was found between distal latency and duration.

**Key words:** F-wave, F-latency, Ulnar nerve, electromyography

## المخلص

**الاهداف:** (1) تحديد القيم الوسطية لعناصر موجة اف الرد: الكمون، والسعة، ومدتها في المعتاد. (2) عمل مقارنة بين اليمين واليسار، وبين أقصى وأقرب قيم وسطية لموجة اف الكمون، وسعتها ومدتها، (3) معرفة التغيرات في عناصر اف الرد ذات الصلة بالنوع والعمر كذلك (4) إيجاد علاقة بين مختلف العناصر لموجة اف الرد. **التصميم:** دراسة مرصديه. الإعدادات: قسم علم وظائف الأعضاء، كلية الطب، جامعة الخرطوم **النتائج:** الدراسة تم انجازها على مائة من الأصحاء الكبار من كلا الجنسين في مختلف العمرية. الفئات في هذه الدراسة هي  $27.6 \pm 0.23$  في المئة حصل عليها ملي ثانية لموجة اف الرد و  $433.75 \pm 17.46$  ملي فولت لسعة الموجة و  $6.27 \pm 0.22$  ملي ثانية لمدة الموجة المقارنة بين اليمين واليسار في القيم الأقصى والقريبة في مختلف العناصر لموجة اف الرد لم تظهر أي اختلاف كبير. كما كشفت الدراسة عن تغيرات في موجة اف أقصى الكمون وأقصى مدة، ذات صلة بالنوع؛ مع اقل قيمة لأف الكمون في الإناث وأقل قيمة لأف المدة في الذكور. وأيضاً كشفت الدراسة عن عدم وجود صلة بين المتغيرات المختلفة لأف الرد والعمر، كما وجد ارتباط كبير بين أقصى القيم وأقربها لأف الرد وكذلك بين اف الكمون والمدة وبين اف السعة والمدة **الاستنتاج:** القيم الوسطية لأف رد الكمون والسعة والمدة التي حصل عليها في هذه الدراسة بين السودانيين الكبار تماثل تلك القيم عالمياً. لا يوجد أي اختلافات بين اليمين واليسار أو بين أقصى القيم وأقربها كما لم تثبت الدراسة وجود صلة بين المتغيرات المختلفة لأف الرد والسن في حين أن موجة الكمون كشفت عن علاقة مع النوع. كما يبدو أن موجة اف المدة ذات صلة أكثر بأف الكمون من صلتها بالنوع، عندما وجد أن أقل قيمة لأف الكمون في الإناث وأقل قيمة لأف المدة في الذكور. يوجد ارتباط قوي بين أقصى القيم وأقربها وبين المتغيرات المختلفة لقيم اف الرد.

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**INTRODUCTION**

F-wave is a measurement of the latency over the afferent and efferent arcs of human motor nerve fibers from the stimulating site to the anterior horn cells [1]. The response is invariably evoked in a normal individual during the motor nerve conduction study by supra-maximal stimulation of the distal portion of the nerve. Nerve conduction study is one of the electro-diagnostic studies, which can be of a valuable asset in the diagnosis and follow up of neuromuscular diseases, however, must be used as an extension of clinical evaluation and not as a routine test [1].

Use of F-wave studies is a recent development in electrophysiology, and abnormalities in F -wave latency, as to those studies, may be the sole abnormality in certain types of peripheral neuropathy when other conduction studies have been normal. [2]. Guillian Barre Syndrome (G.B.S) or post infectious neuropathy, a neuropathy of symmetrical disability commonly associated with antecedent infection and high cerebrospinal fluid protein level with pathological changes of primary demyelination,[3,4] is one of the neuropathies where F-wave may be used for diagnosis even in mild and early cases [5,6].

**SUBJECTS AND METHODS**

Motor nerve conduction studies were performed on one hundred normal adults (males=55, females=45). Selection of the subjects was on voluntary basis, whereby any person fulfilling the inclusion criteria of being a normal adult of the Sudanese nationality of either sex with no symptoms or signs or history of neurological disease. Recording took place by applying surface electrodes and using an electromyography machine, (E.M.G) Medelec MS 92. The F-wave is easily obtained by stimulating the distal portion of the ulnar nerve using motor nerve conduction set-up and changing sweep velocity (msec/division) to 5-10 msec, sensitivity (uv/division) to 500 uv, and stimulus rate of 1/2 seconds. Recording took place with supramaximal intensity and 17 -wave is observed. F-wave latency should be compared with other normal values, more than 2 msec difference between the right and left sides is significant [7].

**RESULTS**

One hundred normal adults male=50 and female=45 with mean ages 38.29± 1.24 and 36.4±1.18 (P> 0.05) respectively, were investigated for F-wave

latency, amplitude and duration of both right and left ulnar nerves using E.M.G machine measurement. Comparisons in F-wave distal and proximal latencies between males and females right and left ulnar nerve are as shown in Tables1,2.

**Table 1: Comparisons in right and left F -wave distal latencies between males and females ulnar nerves**

Test	D.L.RT (msec)		D.L.LT (msec)	
	Males	Females	Males	Females
Sex				
No.	55	45	55	45
Mean ± SE	28.81±0.25	26.31±0.28	28.63±0.26	26.16±0.28
	P = 0.000		P = 0.000	

\*D.L.RT= distal latency right; \*D.L.LT.: distal latency left

**Table 2: Comparisons in right and left F-wave proximal latencies between males and females ulnar nerves**

Test	P.L.RT (msec)		P.L.LT (msec)	
	Males	Females	Males	Females
Sex				
No.	55	45	55	45
Mean ± SE	23.52±0.40	20.99±0.42	23.67±0.28	20.84±0.49
	P = 0.000		P = 0.000	

\*P.L.RT= Proximal latency right; \*P.L.LT.: Proximal latency left

Comparisons in F-wave distal and proximal durations between males and females right and left ulnar nerve are as shown in Table.3, 4.

**Table 3: Comparisons in right and left F-wave distal duration between males and females ulnar nerves**

Test	D.D.RT (msec)		D.D.LT (msec)	
	Males	Females	Males	Females
Sex				
No.	55	45	55	45
Mean ± SE	5.55 ± 0.27	6.99± 0.39	5.78± 0.24	7.04± 0.31
	P = 0.003		P = 0.020	

\*D.D.RT= distal duration right; \*D.D.LT.: distal duration left

**Table 4: Comparison in the total mean of the right and left F -wave proximal duration between males and females ulnar nerves**

Test	P.D.(RT&LT) (msec)	
	Males	Females
Sex		
No.	55	45
Mean ± SE	5.42 ± 0.24	6.49 ± 0.28
	P < 0.05	

\* P.D.RT & LT: proximal duration right and left

The study revealed indirect significant correlations between distal duration and distal latency and between proximal duration and proximal latency ( $P < 0.05$ ). The study also revealed direct significant correlations between distal amplitude and distal latency and between proximal amplitude and proximal latency ( $P < 0.05$ ). There were a strong statistical direct correlations between distal and proximal latency, distal and proximal duration and between distal and proximal amplitude as shown in Figures 1-3.

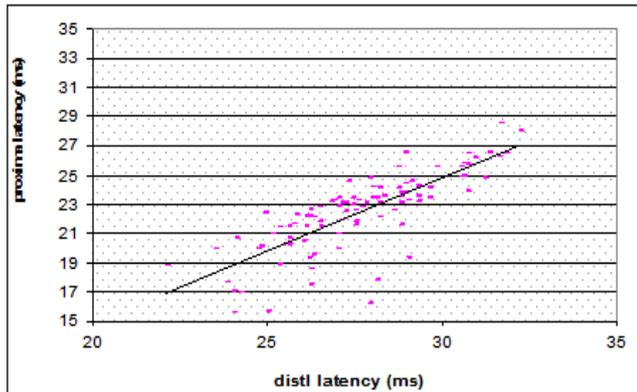


Figure 1: Relationship of proximal latency to distal latency ( $R\text{ Square} = 0.4779$   $P < 0.0001$   $Prob. > F$ )

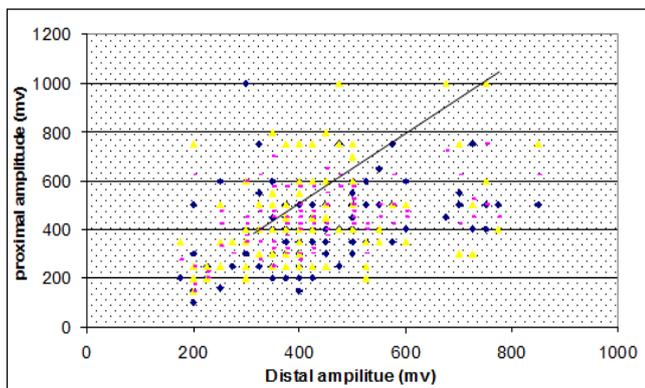


Figure 2: Relationship of proximal amplitude to distal amplitude ( $R\text{ Square} = 0.2149$ ;  $P < .0001$ ;  $Prob. > F$ )

### DISCUSSION

In this study, ulnar nerve conduction on both male and female subjects were investigated. Several F-wave parameters were utilized for measuring normal values for the F-wave main components among Sudanese adults. Comparisons between right and left upper extremities and between distal and proximal values were made. Sex and age related changes were also investigated with a total number of fifty five males and forty five females with mean ages  $38.29 \pm 1.24$  and  $36.4 \pm 1.18$  ( $P > 0.05$ ) respectively.

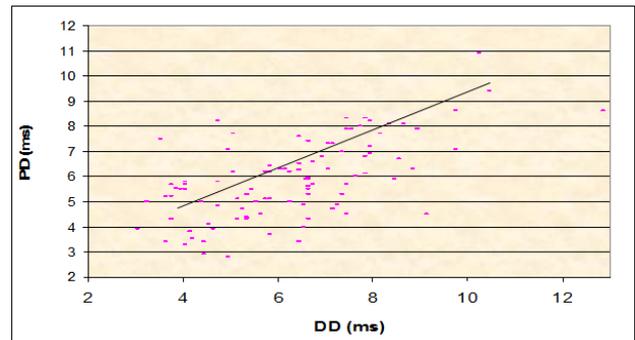


Figure 3: Relationship of proximal duration to distal duration ( $R\text{ Square} = 0.3443$ ;  $P < 0.0001$ ;  $Prob. > F$ )

Correlations between the different F-wave parameters revealed no significant difference in the different F-wave parameters between both sides, including both distal and proximal values. This coincides with similar findings in previous studies elsewhere [8-10]. There were no age related changes in the different F-wave parameters detected in this study, again coinciding similarly with findings reported by Peioglou-Harmoussi, Anantharaman and Bhatrigar, and Clinchot et al [11-13]. The study detected sex related changes in the F-wave latency and duration, females reporting shorter latency while males reporting shorter duration. This difference in the F-wave latency between adult Sudanese men and women supports the work of Bruno Gregori et al who documented similar findings, [14] and who observed a difference in the F-wave latency parameter only suggesting that F-wave duration is more related to F-wave latency than to sex, a finding that could be also proved in our study as an inverse relationship. Another two interesting findings were that direct relationships were found between F-wave amplitude and duration, and between distal and proximal values (Figure 1-3).

### CONCLUSION

The mean values of the ulnar nerve F-wave components in healthy Sudanese adults seem to be similar to universal figures. No dissimilarities reported between distal and proximal values of the F-wave amplitude and duration and between right and left upper extremities in the different F-wave parameters, and no age related changes could be proved. While F-wave latency revealed a relationship with sex, F-wave duration seems to be more related to F-latency than to sex, with shorter latency in females and shorter duration in males. Strong positive correlations between distal and proximal

values and between distal amplitude and duration, while a negative correlation between distal latency and duration, were suggested.

### COMPETING INTEREST

The authors declare that they have no competing interests.

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