Diagnostics and imaging procedures

AB1523 CLINICAL SIGNS AND ACTIVITY LIMITATIONS ASSOCIATED WITH DURAL SAC ECTASIA IN INDIVIDUALS WITH MARFAN DISEASE: A CROSS-SECTIONAL CASE-CONTROL STUDY

Keywords: Cardiovascular disease, Rare/orphan diseases, Patient reported outcomes

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Background: Dural ectasia often occurs in individuals with Marfan disease. Fibrillin-1, a matrix component of microfibrils, has been hypothesized to play a role in the circulation of cerebrospinal fluid [1]. Modifications to the circulation of cerebrospinal fluid in individuals with Marfan disease may lead to an increased pressure in the lumbosacral spine and a decreased pressure in the cephalic extremity.
Objectives: We hypothesized that individuals with Marfan disease and dural ectasia, as compared to individuals with Marfan disease without dural ectasia, may display a specific pattern of painful symptoms and spine-specific activity limitations [2]. The aim of our study was to compare: the frequencies and characteristics of painful symptoms, and the intensity of back and leg pain, spine-specific activity limitations and health-related quality of life, between individuals with Marfan disease with and without dural ectasia.
Methods: We conducted a single-centred cross-sectional comparative study. All individuals with Marfan disease followed in the department of cardiology of Bichat hospital (Paris, France) and recorded in the computerized database of the department from inception to January 2022 were systematically screened. Inclusion criteria were: adults ≥ 18 and ≤ 55 years; fulfilling Ghent nosology; FBN1 mutations confirmed by genetic testing; and CT-scan or magnetic resonance imaging available. Non-inclusion criteria were: history of lumbar surgery < 1 year; specific back pain (i.e. tumor, infection, traumatism, fracture, inflammatory rheumatic disease); individuals unable to speak, read and write French. Individuals were considered to have dural ectasia or not to have dural ectasia based on CT-scan or magnetic resonance imaging, according to Ahn and colleagues' criteria [3]. All self-administered questionnaires collected between 1/28/2022 and 9/12/2022 were included in the analysis.
Results: 247 individuals were eligible to participate and were contacted by mail. 90 (36%) individuals accepted to participate and were included: 55 (61%) had dural ectasia and 45 (39%) did not **(Figure 1)**. Mean participants' age was 39.3 (9.4) years and 45 (50%) were women. 80 (89%) participants had back pain, most often located in the lower back, 65 (71%) a history of scoliosis and 8 (9%) a history of spine surgery. 15 (17%) participants had a history of high blood pressure, 84 (93%) a dilation and/or dissection of the ascending aorta, and 52 (58%) an aortic surgery. The 3 most often reported painful symptoms were increased pain in the lower back with upright posture in 53 (58%) participants, increased headache with upright posture in 36 (40%) and increased pain in the lower back when walking in 31 (34%). The frequencies of increased headache with upright posture and of increased pain in the lower back when coughing, laughing and/or sneezing were numerically higher in participants with than without dural ectasia (49% vs 26% and 13% vs 0%, respectively), without reaching statistical significance (p-value=0.030 and p-value=0.021, respectively) **(Table 1)**.
Conclusion: Individuals with Marfan disease and dural ectasia, as compared to those without dural ectasia, display a specific pattern of painful symptoms, including lower back pain and headache with upright posture. We detected too a difference in favor of a link between ectasia of the dural sac and abundance in ascending aortic surgery (64% vs 49%).

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AB1524 A NOVEL ACCELEROMETRY-BASED METHOD FOR EARLY DETECTION OF PERIPHERAL NEUROPATHY ASSOCIATED WITH SYSTEMIC AUTOIMMUNE RHEUMATIC DISEASES

Keywords: Telemedicine, Diagnostic tests, Validation

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Background: Systemic autoimmune rheumatic diseases (SARDs) such as systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), primary Sjögren's syndrome (SS), and systemic sclerosis (SSc) occasionally affect the peripheral nervous system. Nerve conduction studies (NCS) can almost certainly confirm the diagnosis of SARD-associated neuropathy. The NCS method is usually considered the gold standard for neuropathy assessment, although this method is based on physicians' knowledge and experience. However, it is painful for patients, long-lasting, prone to errors, and can't be used for routine follow-up. There is an urgent need for potential alternative diagnostic screening methods for implementation in everyday practice. Wearable sensor devices, such as accelerometers, are instruments that can be utilized to acquire data during different activities. Their size and wirelessness, lower cost, portability, and use in home-based and real-life situations are a few of the advantages.
Objectives: To evaluate a telemedicine wearable device with a machine learning algorithm that can be used as a screening and tracking tool for SARD-related neuropathy.
Methods: A monocentric, diagnostic study was conducted at the Institute of Rheumatology in 2020. The participants were healthy volunteers and SARD patients who had suspected neuropathy. The participant started with the NCS examination; electrodes were placed on the limbs, and amplitude, latency, and conduction velocity of n. medianus, n. ulnaris, n. peroneus, n. tibialis, and n. supraspinatus (motor and sensory fibres) were measured. The novel method consists of four wearable sensors placed over the middle of the hands and feet. The subject performed six exercises with open and closed eyes. Raw data was sent through the Bluetooth connection from the sensors to the tablet and then via WiFi connection to the central server for further analysis. A wearable device uses a specific mathematical algorithm that transforms signals from the accelerometer and gyroscope into specific values. The outcome is defined as a binary variable: whether or not neuropathy exists.
Results: The study included 23 participants (9 ♂ and 14 ♀), 11 with SARDs (45.8%). Of the total number of SARD participants, 8 (72.7%) had neuropathy confirmed with the NCS examination. The features (such as acceleration or power) obtained with signal processing were examined, and only those that can be used to discriminate SARD-related neuropathy are presented (Table 1). The model for binary classification was developed and presented in Table 2. As shown, the sensitivity and specificity are satisfactory, but the confidence intervals are still wide. Positive predictive value is significantly lower compared to negative predictive value.
Conclusion: Wearable sensors represent accurate and promising technology for the diagnosis of neuropathies related to SARDs. Further studies are needed to evaluate the true accuracy of the technology.

Table 1. The features used to discriminate neuropathy

	Neuropathy (NCS)		p value
	No (15)	Yes (8)	
EXC 1 heel-toe walk			
SDP LL Heels 10hz	0.01±0.01	0.01±0.003	0.02
SDP Acc Norm LL Heels	0.1±0.05	0.06±0.03	0.01
EXC 2 tandem walk			
SigPow Acc Norm RL Min	1.5±0.2	1.33±0.13	0.07
EXC 3 heel-knee test			
CorrSeg Acc Norm LL CIE	0.03±0.03	0.01±0.02	0.03
DiffSig Acc Norm LL_LL OpE	0.06±0.1	0.02±0.015	0.2
DiffSig Acc Norm RL_RL OpE	0.05±0.1	0.03±0.06	0.5
CorrSeg Acc Norm LL CIE Std	0.7±0.23	0.44±0.16	0.03
EXC 4 Romberg test			
Var Acc Norm LL CloseEye	0.1±0.15	0.28±0.3	0.04
EXC 5 postural tremor			
StatPos AbsDiff RA Max	0.02±0.01	0.01±0.01	0.07
Var Acc Norm LA BefAft	1.2±0.6	0.71±0.2	0.05
EXC 6 finger-nose			
DiffSig Acc Norm RA_RA OpE	1.0±0.02	0.97±0.1	0.01
Exp Acc Norm RA TotPow	0.003±0.01	-0.02±0.03	0.01

Table 2. Validation of new proposed model for neuropathy screening

Model	NCS - (n=15)	NCS + (N=8)	Sn	Sp	PPV	NPV
1 FT EXC 1 + 4 WS + FT EXC 3	3	7	0.875 (0.466-0.993)	0.800 (0.513-0.946)	0.700 (0.513–0.946)	0.923 (0.621–0.996)
WS -	12	1				

Abb. FT – feature, WS – wearable sensors, NCS – nerve condution studies

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AB1525 THE PRESENCE OF POWER DOPPLER SIGNALS IN THE DELTOID LIGAMENT, ESPECIALLY WITH A BROAD AND DEEP DISTRIBUTION, MAY PROVIDE DIAGNOSTIC CLUES FOR SPONDYLOARTHRITIS, PARTICULARLY UNDIFFERENTIATED SPONDYLOARTHRITIS

Keywords: Ultrasound, Rheumatoid arthritis, Spondyloarthritis

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Background: Power Doppler (PD) signals are occasionally detected in the deltoid ligament on musculoskeletal ultrasound (MSUS) examination of symptomatic ankles in nontraumatic inflammatory rheumatic diseases. However, it is often neglected due to its unclear clinical significance.

Objectives: To evaluate the significance of PD signals in the deltoid ligament detected by MSUS in inflammatory rheumatic diseases.

Methods: We reviewed the record of MSUS examined in Japanese Red Cross Medical Center between April 2015 and October 2022. We examined the characteristics of medical record information and images of cases in which power Doppler signals were observed in the deltoid ligament. Patients with only a few punctate signals or less were excluded. Patients with only traumatic or degenerative disorders were also excluded.

Results: PD signals more than a few punctate signals were observed in the deltoid ligament in 31 cases. The disease categories and diagnoses of the patients were as follows: 13 spondyloarthritis (SpA) patients (9 undifferentiated SpA (USpA), 2 psoriatic arthritis, 2 reactive arthritis), 10 rheumatoid arthritis (RA) patients (6 early RA, 4 established RA), 7 crystal-induced arthritis (CIA) (6 gout, 1 CPPD), and 1 primary Sjögren's syndrome. All SpA patients met the ASAS criteria for peripheral SpA and all RA patients fulfilled the 2010 ACR/EULAR classification criteria. In SpA cases, PD signals tended to distribute widely to the deep layer of the ligament (broad distribution, 10 out of 13 cases), while they tended to be predominant on the outer surface of the ligament in RA cases (superficial distribution, 7 out of 10 cases). There was a significant difference in the PD signal distribution pattern between SpA and RA by Fisher's exact test (p=0.0397). In all CIA patients, hyperechoic materials were detected in the ligament.

Conclusion: According to literature reports, SpA is considered relatively rare in Japan, where the HLA-B27 positivity rate is < 0.3%, with an estimated population prevalence of < 0.01% [1]. The estimated prevalence of patients with RA in Japan is 0.65% [2], similar to the rest of the world. Considering the prevalence of each disease, we speculate that PD signals in the deltoid ligament are more characteristic of SpA. The presence of PD signals in the deltoid ligament, especially with a broad and deep distribution, may provide diagnostic clues for SpA, particularly USpA.

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Table 1.

Disease category & diagnosis	Number of our patients with PD signals in the deltoid ligament	Estimated prevalence in Japan reported in the literature	Distribution of PD signals in the deltoid ligament	
			superficial	broad
Spondyloarthritis	13	< 0.01% [*Ref1]	3	10
Undifferentiated spondyloarthritis	9			
Psoriatic arthritis	2			
Reactive arthritis	2			
Rheumatoid arthritis	10	0.65% [*Ref2]	7	3
Crystal-induced arthritis	7		1	6
Gout	6			
CPPD	1			

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AB1527 TELEDIDACTIC MUSCULOSKELETAL ULTRASOUND COURSE AND COMPARISON WITH CONVENTIONAL ON-CAMPUS TRAINING – INTERIM ANALYSIS OF THE TELMUS STUDY

Keywords: Ultrasound, Education

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Background: Musculoskeletal ultrasound (MSUS) is increasingly gaining importance as an imaging tool in rheumatology. Most training programs currently address resident doctors. However, several studies have demonstrated that teaching MSUS to medical students improves their palpation skills and understanding of musculoskeletal anatomy. With the development of portable ultrasound devices, MSUS education is lately getting more flexible and location-independent. In addition, the COVID-19 pandemic raised awareness of telemedicine training as a powerful tool to ensure the teaching of practical skills under pandemic conditions.

Objectives: The purpose of our study is to establish a telemedical MSUS course for medical students and to compare its effectiveness with a conventional on-campus course as a world-wide pilot study. In doing so, we aim to expand student educational opportunities in MSUS using innovative teaching options while ensuring quality maintenance of teaching.

Methods: Thirty medical students were randomized to either a virtual group being delivered only telemedicine instructions, or an on-campus cohort receiving the course in a conventional format. Each student was provided with a hand-held ultrasound device. Prior to the start of the course, the students' skills were assessed with an Objective Clinical Structured Examination (OSCE). During the course, a DEGUM-III-certified course instructor taught the basic physics of ultrasound and standard sections of the MUDE ultrasound protocol[1]. In order to quantify the students' learning progress, a second OSCE was carried out after completion of the course. [1].

Results: At the time of this analysis, data collection within the on-campus course has already been completed, whereas the virtual course is still ongoing. While the average score of the students in the PRE-course OSCE was 21,02% (SD ±6,78), the students were able to achieve an average of 90% (SD ±6,81) in the POST-course OSCE after the intervention.

Conclusion: With the results obtained so far, it can be shown that an innovative course concept with hand-held ultrasound devices, originally developed for dermatologists to improve the detection of psoriatic arthritis, can be used very well in student teaching without major modifications and leads to a significant increase in MSUS skills among medical students. The TELMUS study thereby offers a successful example of extending an existing course concept to student teaching and thus promoting the next generation of rheumatologists.

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