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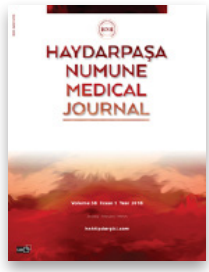

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ORIGINAL ARTICLE

An Assessment of the Knowledge, Attitudes, and Practices of Pediatricians and Pediatric Residents in Spinal Muscular Atrophy

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Abstract

Introduction: This study aims to investigate the knowledge levels and attitude of pediatricians and pediatric residents toward spinal muscular atrophy (SMA), which is one of the most frequent neuromuscular diseases and the second most common cause of mortality among autosomal recessive diseases.

Methods: Pediatric residents and pediatricians were asked to answer a questionnaire consisting of 27 questions prepared by the authors. The questionnaire investigated knowledge levels and attitudes concerning genetic, pathophysiologic, and laboratory characteristics, in addition to follow-up and management features of SMA. The questionnaire was distributed using Google Forms (Google LLC, Mountain View, CA, USA).

Results: Ninety-three physicians (48.4% (n=45) pediatricians, 15.1% (n=14) fellows, and 36.6% (n=34) pediatric residents) responded to the questionnaire. Of these, 56 (60.2%) had experience of working in a pediatric clinic for more than 5 years and 95.7% (n=89) had followed an SMA patient. Sixty-eight (73.1%) of the participants knew that a deletion in exon 7–8 was the cause of SMA in more than 95% of patients, 83 (89.2%) knew that it was characterized by progressive loss of motor neurons in the anterior horn, 86 (92.5%) knew that SMA classification was made based on the onset time of symptoms and genetic features, and 92 (98.9%) believed that SMA subtypes could define the prognosis. Ninety (96.8%) stated that the most important cause of mortality was the involvement of accessory respiratory muscles.

Discussion and Conclusion: This study revealed that physicians possess a satisfactory level of knowledge concerning the symptomatology, diagnostic algorithm, and follow-up features of SMA disease, which has become more popular following the development of treatments that could prolong survival and improve the quality of life. Modern treatment options are expected to change the natural course of the disease, and pediatricians are expected to stay up-to-date with the changing algorithms for diagnosis, follow-up, and treatment.

Keywords: Attitude; knowledge; neuromuscular disease; rare disease; spinal muscular atrophy.

Spinal muscular atrophy (SMA) is a neuromuscular disease caused by a mutation – most commonly a deletion – in the survival motor neuron 1 (SMN1) gene that results in progressive loss of alpha motor neurons in the medulla spinalis giving rise to progressive muscle atrophy and weakness[1,2]. It is more prevalent in countries such as

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ours where consanguineous marriages are usual due to its autosomal recessive genetic pattern[1,2]. Gene-based severity-reducing treatment options have caused changes in the natural course and follow-up protocols of the disease in the last decade[2,3]. Early diagnosis plays an important in the effectiveness of the treatment, and thus, primary physicians of these patients need to have greater vigilance concerning symptoms and diagnostic algorithms. On the other hand, new treatment options have made a longer survival possible and medical care of SMA patients has undergone considerable change to provide a higher quality of life[3]. In a study which was published nearly 3 years ago, the Swedish nationwide survey, the families of SMA patients were asked about their expectations from health-care providers. More than half of the parents expressed higher expectations concerning healthcare provider – family relationship with the second most common expectation being health-care professionals possessing a higher level of disease-specific knowledge[4]. Participants of the study have proposed that SMA patients could be a part of the education of health-care professionals and have stated that they desired to interact with health-care professionals who were up to date with recent developments and would clearly present data on prognosis and treatment options[4]. Studies involving families and legal guardians who provided care for these patients yielded similar results[5-7]. Bashiri et al.[8] have conducted a study among physicians who manage SMA patients in the Kingdom of Saudi Arabia. The study cohort included pediatric neurologists and physicians of other subspecialties. The study revealed that 169 participants were aware of the consensus guidelines for the care of SMA patients and the authors emphasized a need for increased awareness of consensus guidelines and further awareness about the physician's role. Although a multi/interdisciplinary team is responsible from the follow-up and treatment of SMA patients, the knowledge levels and attitudes of pediatric residents and pediatricians are very important as they are often the first clinicians to meet these patients[9]. At this point, we aimed to evaluate the knowledge levels and attitude of pediatric residents and pediatricians concerning SMA through a structured questionnaire.

Materials and Methods

Ethics committee approval was obtained from the Turkish Ministry of Health Antalya Research and Education Hospital non-interventional studies ethics committee (2021–171). The study has been conducted in accordance with the Helsinki guidelines.

This prospective cross-sectional study aims to evaluate pediatricians and pediatric residents from Turkey from private hospitals and clinics, government hospitals, and university clinics and was conducted between July 3rd and 10th 2020. The questionnaire was prepared by four to evaluate knowledge, attitude, and practice concerning pediatric patients with SMA. A random sampling method has been used in the study. The questionnaire form was filled by 93 pediatricians and pediatric residents from all parts of the country which was submitted online using

Table 1. Summaries of the answers of the questions on genetics of SMA

Statement	Choices	Responses (n,%)
SMA has an autosomal recessive inheritance pattern	True	84 (90.3)
	False	4 (4.3)
	No idea	5 (5.4)
SMA is more prevalent in countries where consanguineous marriage is common due to its autosomal recessive inheritance pattern	True	83 (89.2)
	False	6 (6.5)
	No idea	4 (4.3)
A deletion in the 7-8th exons of the SMN1 gene is detected in more than 95% of SMA patients	True	68 (73.1)
	False	2 (2.2)
	No idea	23 (24.7)
Which of the folowing do not benefit from genetic studies planned for SMA?	Disease classification	4 (4.3)
	Prognostic data	2 (2.2)
	Managing treatment	2 (2.2)
	Detection of carriers in the family and genetic counselling	3 (3.2)
	Determination of stretching and strength exercises for physiotherapy	82 (88.2)

Table 2. Questions and answers on clinical signs and symptoms of SMA

Statement	Choices	Responses (n,%)
Hypotonia, progressive muscle weakness and atrophy are observed in SMA patients	True	93 (100)
	False	-
	No idea	-
Tongue fasciculations can be observed in SMA patients	True	92 (98.9)
	False	1 (1.1)
	No idea	-
Mental deficiency can be observed from the onset of disease	True	4 (4.3)
	False	87 (93.5)
	No idea	2 (2.2)
Delay in motor development, hypotonia, weakness in different degrees, insufficient weight gain, scoliosis, fasciculations of the tongue, loss of deep tendon reflexes can be observed in all types of SMA	True	47 (50.5)
	False	43 (46.2)
	No idea	3 (3.2)
The most important cause of mortality in SMA patients is the involvement of accessory respiratory muscles	True	90 (96.8)
	False	3 (3.2)
	No idea	-

Google Forms (Alphabet, Mountain View, CA, USA), and informed consent was obtained online by adding the "Informed Consent Form" to the questionnaire. The questionnaire consisted of 27 questions (supplementary material). 4 multiple choice questions investigated demographic data, whereas 4 questions were about genetic features, 2 were about pathophysiology, 3 were about classification, 5 were about clinical features, and 2 were about diagnostic features. 7 dichotomous questions aimed to investigate clinical and follow-up features. The participants were not allowed to take the next question without answering the current one and thus there were no unanswered questions, and missing data were avoided to ensure the ease of evaluation.

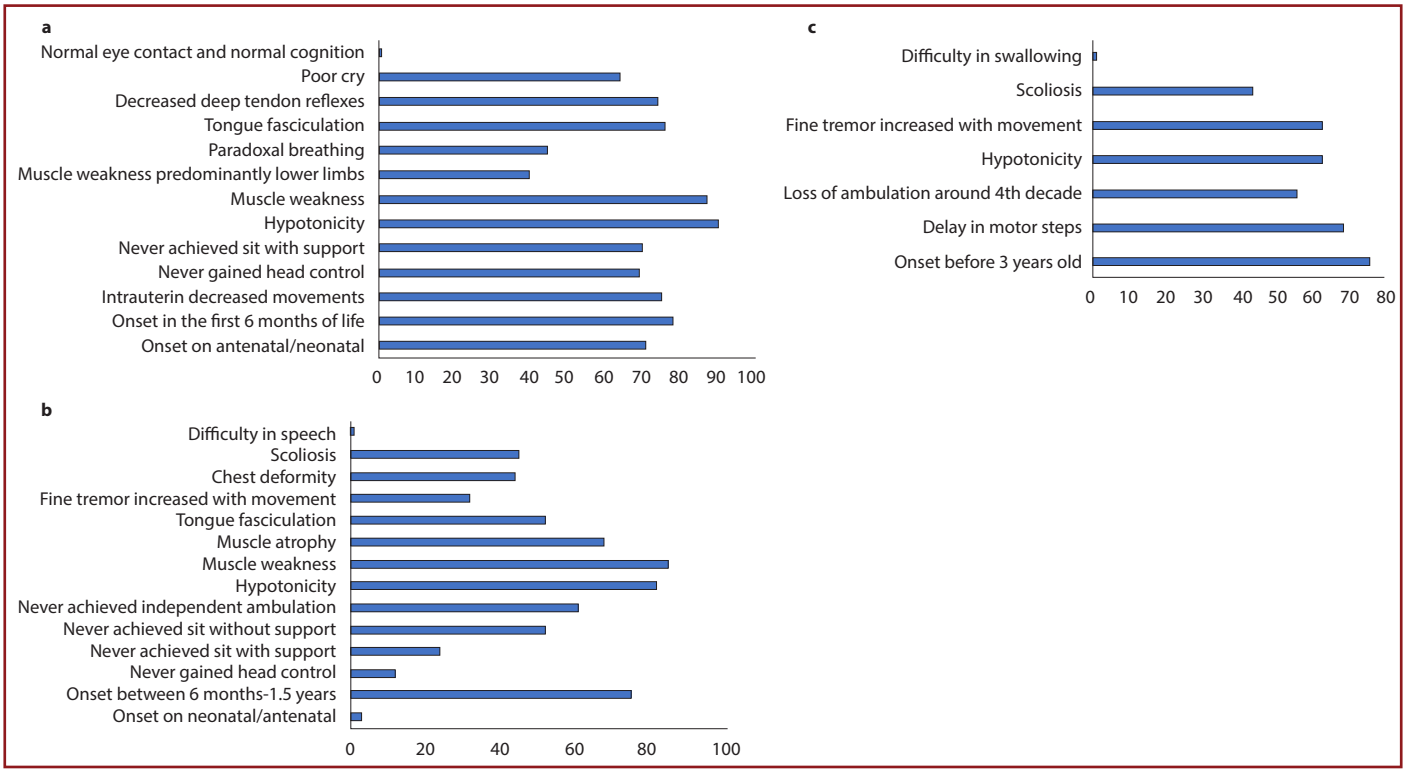

Figure 1. Questions and answers concerning clinical signs and symptoms of SMA Type 1 (a), 2 (b) and 3 (c).

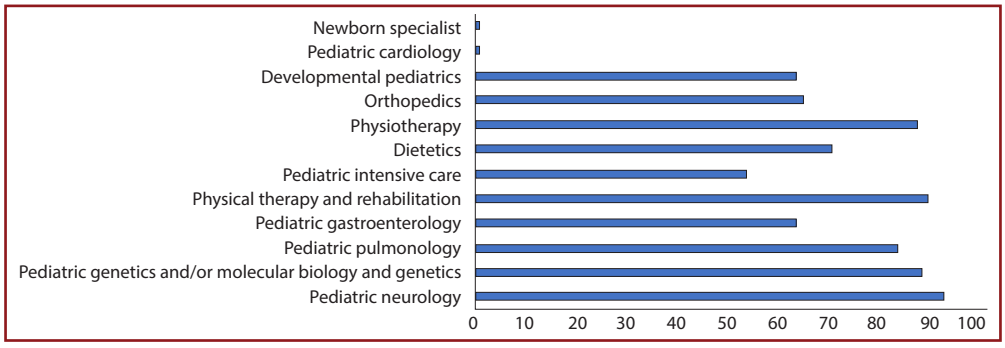

Figure 2. Department(s) which should be responsible for the follow-up of SMA patients.

All answers and data were performed as the number of cases (n) and percentages (%) using SPSS for Windows, version 22.0 (SPSS Inc., Chicago, IL, United States).

Results

The study was completed with a total of 93 participants, of which 48.4% (n=45) were pediatricians, 15.1% (n=14) were pediatric fellows, and 36.6% (n=34) were pediatric residents. Work experience in a pediatric clinic of the participants was distributed as follows: 37.6% (n=35) more than 10 years, 22.6% (n=21) 5–10 years, 16.1% (n=15) 3–5 years, 14% (n=13) 1–3 years, 4.3% (n=4) 6–12 months, and 5.4% (n=5) <6 months. 76.3% (n=71) was working in a clinic that acted as a diagnostic and treatment center for neuromuscular diseases. While 4 (3.2%) of the participants had never encountered a SMA patient, 46.2% (n=43) had participated in the diagnosis and treatment of 1–10 SMA patients and 49.5% (n=46) had participated in the diagnosis and treatment of 10 or more SMA patients.

Four statements intended to question the knowledge on genetic features of SMA and their responses are summarized in Table 1.

The statement "SMA is characterized by a loss of motor neurons in the anterior horn" which was intended to evaluate knowledge about SMA pathophysiology was answered as "true" by 89.2% (n=83), as "false" by 4.3% (n=4) of the participants, whereas 6.5% (n=6) answered "no idea." Another statement "SMA affects only smooth muscles" which was intended to evaluate knowledge on SMA pathophysiology was answered as "false" by 92.5% (n=86) and as "true" by 7.5% (n=7) of the participants.

Sixty-two (66.7%) of the participants responded that SMA was classified as types 1, 2, 3, and 4, whereas 17 (18.3%) believed this to be false and 14 (15.1%) had no idea. 92.5% (n=86) of the participants stated that the type of SMA was determined by the onset of symptoms and genetic features, whereas 2.2% (n=2) stated that this was not correct and 5.4% (n=5) had no idea. 98.9% (n=92) of the participants believed that SMA type could determine prognosis.

Eight (8.6%) of the participants accepted "Genetic studies are not necessary for the definitive diagnosis of SMA, family history, and clinical findings are sufficient" as correct, whereas 80 (86%) participants believed this statement to be false and 5 (5.4%) had no idea. 72% (n=67) of the participants believed that PSG was the least helpful for diagnosis while 23.7% (n=22) believed that serum CK levels had the least contribution to the diagnosis. The least helpful techniques for diagnosis were reported as SMN1 gene analysis by 1.1% (n=1), SMN2 copy number by 1.1% (n=1), and EMG by 2.2% (n=2) of the participants.

Five statements and responses concerning clinical features of SMA have been summarized in Table 2. Similarly, 3 multiple choice questions concerning clinical features and responses have been summarized in Figure 1.

All participants agreed on the necessity of questioning the patients about recurrent pulmonary infections when asked about the important points in the respiratory examination of the SMA patients. 94.6% (n=88) of the participants believed that deformities of the chest wall should be investigated, 69.9% (n=65) believed that skin should be examined for cyanosis or pallor, 80,6% (n=75) believed that the patients should be examined for paradoxical breathing, and the same number of participants believed that adequate coughing should be evaluated. 84.9% (n=79) of the participants stated that oxygenation during the night should be evaluated, 91.4% (n=85) stated that need for tracheostomy should be investigated and 68.8% stated that the existence of scoliosis should be investigated.

Gastroenterological problems of SMA patients were also investigated. 95.7% (n=89) of the participants reported chewing-swallowing problems, 93.5% (n=87) reported

constipation, 91.4% (n=85) reported aspiration, 86% (n=80) reported decreased mouth movements, 84.9% (n=79) reported gastroesophageal reflux, and 84.9% (n=79) reported abdominal distension as possible problems. 78.5% (n=73) of the responders reported that these patients should be questioned concerning insufficient or excessive calorie intake.

Possible postanesthetic respiratory problems in SMA patients were reported as prolonged mechanical ventilation by 94.6% (n=88), atelectasis by 81.7% (n=76), hypoventilation by 72% (n=67), nosocomial infections by 57% (n=53), upper airway infection by 49.5% (n=46), and increased malignant hyperthermia risk by 49.5% (n=46) of the participants.

Answers to question concerning which department(s) should be responsible for the follow-up of SMA patients have been summarized in Figure 2.

Discussion

Treatments that could improve the quality of life and the fact that early diagnosis could affect treatment efficiency have rendered the awareness about this disease even more important[10]. Although the number of studies investigating the level of awareness, knowledge, and attitude of families is low and these studies are local, their results show that the level of public awareness about SMA is very low despite the high number of possible carriers[11]. There are even fewer studies focusing on the level of awareness among physicians. One such study has been carried out in Sri Lanka among medical students and new graduates where the level of awareness concerning SMA type 1 was investigated, the results were reported as 59%[9]. Currently, there is no study investigating the level of awareness among pediatric fellows and pediatricians which is the group that most frequently encounters the pediatric patients.

The incidence of all types of SMA has been reported as around 10 in 100.000 (1 in 10.000) live births[12]. Although there is not definitive data on the incidence of SMA in our country, given the fact that autosomal recessive diseases are common due to consanguineous marriages and more than 60% of the SMA cases are diagnosed in the early childhood, it is obvious that the pathophysiology, clinical features, and diagnostic and treatment algorithms are major concerns for pediatricians[1-3,12]. In our study population with 37.6% reporting more than 10 years of experience, 96.8% of the participants reported having encountered at least one SMA patient, while 49.5% reported having encountered 10 or more SMA patients. This can be considered as a solid evidence that pediatricians and pediatric fellows have a high rate of encountering and managing patient with SMA.

Genetic and clinical features of the SMA patient are very important where prognosis, treatment options, and genetic counseling are concerned[1-3]. Kesari et al.[13] have evaluated the awareness and attitudes of primary physicians and obstetricians over 8 SMA patients and have reported that doctors lack sufficient clinical and genetic knowledge and tended to adopt a more sympathetic approach instead of presenting the facts to the patients. Our study has revealed that the majority of participants had sufficient knowledge concerning the inheritance pattern of SMA but lacked knowledge on the type of mutation in SMN1, classification of the disease based on genetic features, prognosis, treatment management, detection of carriers in the family, and genetic counseling. The majority of participants have correctly answered the statements concerning the pathophysiology of the disease. A diagnosis of SMA can be made through molecular genetic studies[1-3]. However, 8.6% of the participants believed that genetic studies were not necessary for the diagnosis, stating that family history, and clinical findings were sufficient for a definitive diagnosis. On the other hand, SMN1 gene analysis in addition to serum CK levels and EMG can be utilized as auxiliary tests for diagnosis[1-3]. However, SMN2 copy number alone is not sufficient for diagnosis, whereas it could be helpful. Only four participants reported SMN1 gene analysis, EMG and SMN2 copy number as being less helpful in diagnosis.

SMA is classified into four types based on onset of symptoms and maximum gain in motor capacity. Roughly put, SMA type 1 patients cannot sit without support, SMA type 2 patients cannot walk, SMA type 3 patients can walk until childhood, whereas SMA type 4 patients are diagnosed in the adulthood[1,2]. Hypotonia, progressive muscle weakness, and atrophy are observed in all four groups and all participating clinicians agreed on this fact. Although delay in motor growth, various degrees of weakness, insufficient weight gain, scoliosis, tongue fasciculations, and loss deep tendon reflexes can be seen in all types of SMA, only 50.5% of the participants responded to this statement as correct. The relatively low prevalence of SMA types 2, 3, and 4 could be the reason behind the incorrect answers of pediatric fellows and pediatricians to the questions on genetic features of SMA. On the other hand, the majority of participants responded as "can be seen" to the multiple choice questions on SMA type 1, 2, and 3. The majority of responders stated that normal eye contact and normal intelligence could not be seen in SMA type 1. 4.3% of the participants stated mental retardation was present from onset although SMA does not directly affect cognitive functions. Mental retardation secondary to complications can be seen however; this situation is not caused directly by SMA[1,2,9].

The most important cause of mortality in SMA is the involvement of accessory respiratory muscles,[1,2] but 3.2% of the participants have stated this was incorrect. Although insufficient or excessive calorie intake should be questioned,[1,2] only 78.5% of the participants are aware of this fact.

The follow-up of SMA requires a multi- and interdisciplinary approach[1]. Acute follow up of SMA patients should be performed by the newborn intensive care, pediatric emergency, and intensive care units, whereas the chronic follow-up should be performed by the pediatrics, social pediatrics in addition to pediatric neurology, pulmonology, orthopedics, physical therapy and rehabilitation, nutrition, and dietetics staff[1,2]. More than 50% of the participants were aware of the necessity of follow-up by these departments except for newborn intensive care unit. On the other hand, the knowledge level and attitude of every sub-department on disease management and consensus is the subject of separate studies. This situation seems to be related to the fact that healthcare providers working in neuromuscular diseases are educated and have larger clinical experience. Similarly, centers for neuromuscular diseases have become more widespread in our country recently in order to manage these patients more closely. The fact that 76.3% (n=71) of the participants are working in such centers points out to the fact that considerable progress has been achieved toward this end.

Our study is first in the literature as it evaluates the knowledge level, attitudes, and awareness of pediatric fellows and pediatricians on SMA who have the highest probability of encountering these patients as they often evaluate pediatric patients. Our study has some major limitations and results cannot be generalized due to the limited sample size. The responses of the participants are limited to those provided in the multiple choice questions which were posted online. More and generalizable data can be obtained from a study conducted face to face on a bigger group of clinicians consisting of those who work in pediatric subspecialties investigating knowledge levels and attitudes.

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Conflict of Interest: None declared.

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