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Pediatric Eye Emergencies and Knowledge Survey ("PEEKS") Among Pediatricians and Family Physicians in Tabuk, Saudi Arabia: A Cross-Sectional Survey

Dr. Naif Mamdouh Alali[1*], Dr. Mohammed Hussen Sheikh[2], Dr. Abdullah Alhewiti[3], Dr. Laila A. AlBishi[4], Dr. Abdullah H. Altemani[5], Dr. Naif Mutkhan Alsharari[6], Dr. Sadeem Abdullah AlRuwaili[7], Dr. Sultan Naif Alsharari[8], Dr. Warif Nasser Alghofaily[9], Dr. Abdulmalik Naif Alali[10], Dr. Raneem Fadhel Asiri[11], Dr. Amani Abdulmanam Alali[12], Dr. Moustafa S. Magliyah[13] and Dr. Shaker O. Alreshidi[14]

[1]Department of Surgery, Division of Ophthalmology, Faculty of Medicine, University of Tabuk, Tabuk, Saudi Arabia
[2-4]Department of Pediatrics, Faculty of Medicine, University of Tabuk, Tabuk, Saudi Arabia
[3,5]Department of Family and Community Medicine, Faculty of Medicine, University of Tabuk, Tabuk, Saudi Arabia
[6]Department of Pediatrics, Neonatal Intensive Care Unit (NICU), Maternity and Children's Hospital, Tabuk, Saudi Arabia
[7-12]General Physician, Ministry of Health, Tabuk, Saudi Arabia
[13]Vitreoretinal Division, King Khaled Eye Specialist Hospital, Riyadh, Saudi Arabia
[14]Ophthalmology Division, Department of Surgical Specialties, College of Medicine, Majmaah University, P.O. Box 66, Majmaah 11952, Saudi Arabia

Author Designation: [1]Associate Professor, [2-4]Assistant Professor, [6]Consultant Pediatrician, [7-12]General Physician, [13]Consultant Retina Specialist

*Corresponding author: Dr. Naif M. Alali (e-mail: nmalali@ut.edu.sa).

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Abstract **Purpose:** The aim was to determine the knowledge of pediatricians and family medicine physicians about pediatric eye diseases in Tabuk, Saudi Arabia and uncover knowledge gaps according to specialty and clinical experience. **Methods:** The target group was identified in the regional government records. Invitations to complete the cross-sectional web-based survey using the questionnaire translated into the Arabic language and used previously without any modifications have been sent. Differences in the knowledge of sub-groups have been calculated on the basis of specialty, clinical experience, attending ROP workshops and routine eye examinations practice. **Results:** There were 53 respondents of whom 62.3% were male and 70% - family physicians. The mean age was 39.7±11.0 and median clinical experience - 10 years. Just over half of them understood that leukocoria might put sight (58.5%) or life (54.7%) at risk. Selection of the immediate referral strategy has been made by 90.6%. Concerning the ROP, just under 80% of respondents recognized all risk factors correctly, but 32.1% chose the right referral time according to the questionnaire. Among respondents with ≤10 years of practice it was chosen only by 14.3% and in those with >10 years of practice - 52% (p = 0.007). The proportion of those who knew about the connection between refractive errors and strabismus was 69%. There were only 34% of respondents recognizing tearing as one of the signs of congenital glaucoma. The selection of the immediate referral strategy has been done in case of strabismus (88.7%) and congenital glaucoma (92.5%). **Conclusion:** Respondents have often made the choice of the immediate referral strategy when they faced sight-threatening conditions. In particular, knowledge gaps were related to the timing of ROP referrals, strabismus caused by refractive error and signs of congenital glaucoma. Subgroup-specific results can be further helpful in training priorities in pediatric eye care.

Key Words Pediatric Ophthalmology, Eye Emergencies, Knowledge Assessment, Pediatricians, Family Physicians, Referral Practices, Saudi Arabia

INTRODUCTION

Paediatric eye diseases are the important public health problem and timely detection and referral is essential to avoid lifelong visual impairment. Leukocoria, congenital cataract, retinoblastoma, Retinopathy of Prematurity (ROP), refractive errors, strabismus and congenital glaucoma are the diseases which should be found out in primary care and these are the primary concerns of pediatricians and family medicine physicians. These frontline specialists play an important role in healthcare systems providing early detection of warning signs, first-line treatment and timely referral to the ophthalmic services in many healthcare systems, including in Saudi Arabia [1-5].

The recent KAP study performed by Alzuhairy *et al.* [5] revealed that the pediatricians were quite skilled in their total knowledge score (78.8% got the excellent knowledge score),

but their attitudes and practice were suboptimal, since 30.1% got the excellent attitudes score and 41.6% got the excellent practice score, respectively. Similar results have been obtained in the survey of national family medicine doctors showing that there was the insufficient awareness of amblyopia, strabismus and visual impairment related to refractive errors, as well as varied referral practice [6-8]. The systemic issue has also been revealed in the study of the referral pattern and the lack of knowledge about the timing and criteria of ROP among NICU physicians from Tabuk [3].

The variability of the performance of the frontline clinicians in terms of the recognition of pediatric eye disease and timely referral has been detected in several international studies. As the results show, although family physicians are not the exclusively unaware of these sight-threatening conditions, this is the global issue which should be solved [9,10].

All these studies have pointed out the important gaps, but there are still some shortcomings in the existing body of the literature. Firstly, in the majority of the past studies only pediatricians or family medicine physicians were studied separately, rather than the combination of both. Secondly, the problems of knowledge have been detected at the population level without exploring differences between the subgroups, for instance, the influence of clinical experience, attending the workshops and routine examination of the eyes, which means that only the general recommendations have been given. The implementation of such comprehensive strategies might be complicated and ineffective in terms of hitting the targets. Thirdly, variations of populations and settings of the previous studies do not allow for conclusion on the changes over time.

Given this background, this study has been carried out to reassess the existing knowledge and practice of pediatricians and family medicine physicians in Tabuk in terms of the pediatric eye diseases. This study not only updates the existing knowledge base, but also provides the more sophisticated approach for optimizing the effectiveness of the pediatric eye-care training and early diagnosis efforts in primary care.

METHODS

Study Design and Setting

This is a cross-sectional, survey-based study conducted among pediatricians and family medicine physicians, both practising and in training, in the city of Tabuk in Saudi Arabia, with the objective to assess the Knowledge, Attitude and Practice (KAP) of different clinicians about common childhood ocular conditions such as neonatal red eye, neonatal conjunctivitis, leukocoria, Retinopathy of Prematurity (ROP), refractive errors, strabismus and congenital glaucoma.

Identification and Enrollment of the Participants

The regional health directorate's official database was utilized to get access to the contact information of eligible pediatricians and family medicine physicians practicing or training in health care facilities under the jurisdiction of the Ministry of Health in government and private sectors in Tabuk city. Using official databases, 105 family medicine physicians and 76 pediatricians were identified and approached in Tabuk [11,12].

Participants fulfilling the criteria were contacted through their government email addresses. This email included details regarding the objectives of the study, the voluntary nature of participation and the link for the online survey. Weekly reminders were sent every week to increase participation during the period of data collection. An anonymous survey, in which completing the questionnaire is considered informed consent, was distributed and analyzed. Since the intention of this study was to reach all the eligible physicians in the region, the sample size was not pre-calculated.

Source and Language of the Questionnaire

The previously developed Arabic version of this questionnaire was used as is by following its structure, answering scheme and wording without any changes as described by Hersi *et al.* [1] No pilot test or validation was reported for the locally developed questionnaire. The four components of the questionnaire were Demographic and professional characteristics, Pediatric eye screening practices, Recognition and management of specific pediatric eye conditions and Self-perceived preparedness for pediatric eye care.

Data Collection Method

The Arabic version of the questionnaire was completed using an online survey tool where the participants had separate survey links to prevent multiple submissions. The information submitted was completely anonymized during collection.

Ethical Issues

The procedure complied with all the principles of the Helsinki declaration. Participation in this survey was voluntary and all participants gave informed electronic consent to participate in it. Design, recruitment, informed consent, handling and protection of potential multiple responses were all done as per the guidelines provided by the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) [13].

Analysis

Participants' characteristics, distribution of the responses and group wise comparisons were carried out using descriptive statistics. Group-wise comparisons were carried out between different subgroups based on specialty, having taken a workshop related to pediatric ocular condition, clinical experience years (≤ median versus > median) and examination of children's eyes routinely or not.

Chi-square test or Fisher's exact test was used for association and $p<0.05$ was kept as the threshold of statistical significance. No multiple testing correction was performed. All the subgroup analysis findings were considered to generate hypotheses. Data analysis was carried out using Microsoft Excel and Statistical Analysis Software (R 4.3.3 version) via the AI module of Julius.

RESULTS

In total 53 participants took part in this online survey, giving an approximate participation rate of 29%. Their average age was 39.7±11.0 years (median: 40 years; inter-quartile range: 29-47 years; range 26-63 years). In most cases (n = 57; 62.3%) male sex was dominant. More than half of them were family physicians (n = 37, 70%). Most were working in some clinical position (as family physicians/pediatricians) while 25% were residents (trainees) of different years. Clinical experience years was found to be 10 years (inter quartile range: 4.75-18 years). About one-third of participants previously attended workshops or conferences related to pediatric eye conditions.

General pediatric eye screening practices, knowledge about recognition and management and self-perceived preparedness about eye conditions were assessed for all participants.

General Pediatric Eye Screening Practices

Vision screening of all newborn babies was preferred by almost one-half (47.2%) while 28.3% believed it to happen during well-baby visits. The majority (67.9%) of the participants said that they examine children's eyes. However, eye examination for every child during routine consultation was practiced only by 17% of the respondents. Red reflex test and visual acuity assessment were found to be commonest screening techniques. Among 32% of the participants not examining children's eyes, the common reasons were lack of relation to their profession (15.1%), uncooperative children (13.2%), lack of time (11.3%), or no availability of equipment (11.3%).

Recognition and Management of Common Pediatric Eye Conditions

Neonatal Red Eye and Neonatal Conjunctivitis: The majority (75.5, 73.6 and 69.8%) of participants appropriately chose the causes of a painful red eye to be neonatal conjunctivitis, uveitis and corneal abrasion or trauma, respectively. Immediate referral was opted by 47.2% of them. Management of neonatal conjunctivitis was done by either referring immediately (45.3%) or giving medications first and then referring if necessary (34%). Antibiotic drops were the most commonly used drug of choice (41.5%).

Group Wise Comparisons

Comparing with each other, most knowledge items did not differ across specialty groups or training background in this exploratory subgroup analysis. More family medicine physicians than pediatricians recognized uveitis (81% Vs 56%; p = 0.12), corneal abrasion (78% Vs 50%; p = 0.08) and glaucoma (35% Vs 6%; p = 0.04) as causes of a painful red eye. Physicians not conducting routine examinations of eyes were choosing 'refer immediately after giving drops' choice more (47% Vs 17%; p = 0.04) than those doing routine eye examination. For management option, more number of pediatricians (50%) and fewer number of family physicians (24%) chose "Not applicable" (p = 0.13).

Choices for management of neonatal conjunctivitis differed with the experience of physicians with ≤10 years having preference towards immediate referral (68% Vs 20%; p<0.001) and those >10 years preferring treatment and follow-up (56% Vs 14%; p<0.001). Regarding prescriptions of eye drops, among junior physicians more chose "not applicable" and fewer chose antibiotics for drops as compared to senior physicians. (p = 0.002 and p<0.001, respectively).

Leukocoria and ROP-Related Knowledge and Management

There is good knowledge concerning possible causes of the leukocoria; 64.2% of participants identified cataract and 77.4% of participants mentioned retinoblastoma as possible cause, while slightly above half of the participants know that the disease poses threat both for eyesight (58.5%) and life (54.7%). Nearly all (90.6%) would choose immediate referral in a case of child suspected of having the disease.

Groupwise analysis demonstrates good consistency of knowledge about possible leukocoria causes among various specialists, irrespective of their level of experience, whether or not they visited the workshop and whether or not they have a habit of conducting regular eye examinations; the differences were statistically not significant. There are some similarities between different groups in terms of awareness of threats posed by the leukocoria to patient's eyesight; at the same time, there were no significant results found regarding the threats posed to patients' lives (69% Vs 49%, p = 0.23) and eyesight (38% Vs 68%, p = 0.07). Clinicians with experience of not more than ten years of practice are significantly more prone to acknowledge that the disease threatens patients' lives compared to those who work longer (71.4% Vs 36%, p = 0.009).

At the same time, some differences were found in knowledge of risks factors associated with the retinopathy of prematurity: family medicine physicians chose "all of the risk factors for ROP" more often in comparison with pediatricians (86% Vs 56%, p = 0.03); more experienced clinicians (with experience exceeding ten years) choose the right referral time significantly more often than the less experienced (52% Vs 14.3%, p = 0.007), while less experienced practitioners prefer to answer "I don't know". Management practices were very consistent: all clinicians chose immediate referral in most cases.

Refractive Errors and Squint (Strabismus)

Participants demonstrated good understanding of the possibility of having refractive errors (79% of them) regardless of child's age; besides, 69% know that these errors might cause squint. The following signs were recognized as the indicators of strabismus: deviation of eye (75.5%), face turn (37.7%) and anomalous head posture (24.5%). Amblyopia (79%) was stated as the main concern and immediate referral as the management practice (88.7%).

Clinicians who visited the workshops are much more prone to realize that children may need glasses from any age (94% Vs 71%, p = 0.02) and that refractive errors can cause

squint (94% Vs 57%, p = 0.02). Experienced clinicians (>10 y experience) were more likely to acknowledge that refractive errors might cause squint (80% Vs 61%, p = 0.03) and less likely to choose "I don't know"(8% Vs 36%, p = 0.03). Other comparisons revealed no statistically significant differences: immediate referral chosen more often than others.

Congenital Glaucoma

Hazy cornea (47.2%), large cornea (45.3%), watering (34%) and red eye (39.6%) were chosen as the signs of congenital glaucoma. Almost all (92.5%) would choose immediate referral in most cases, almost none of them will attempt first the medical treatment.

The groupwise analysis demonstrated no statistically significant differences between any subgroups with regard to specialists', workshop's, experience, eye examination practice. The choice of immediate referral made up 89-96% among different groups.

DISCUSSION

Participants had a tendency to make urgent referrals for eye conditions associated with high risk for children, which was supplemented by gaps in the awareness of some of the clinical features and referrals for these conditions. Participants demonstrated high levels of awareness regarding the main causes of leukocoria such as cataract and retinoblastoma and almost everyone recommended making an urgent referral for leukocoria, congenital cataract, squint and congenital glaucoma. Awareness of the common causes of the red eye in newborns such as conjunctivitis, uveitis and corneal abrasion was relatively high as well and antibiotic drops were used the most for the treatment of conjunctivitis in newborns. Knowledge about refractive errors and strabismus was adequate. Nonetheless, the above-mentioned strengths in the awareness of eye conditions among clinicians were accompanied by several gaps in the knowledge of specific areas related to eye conditions that require more attention.

One of the key findings that emerged in this survey was the poor level of awareness of the severity of leukocoria [1]. Most of the participants selected urgent referral. The specialty differences in the awareness of sight and life-threatening consequences were unclear. Referral was urgent since leukocoria requires urgent referral due to life-threatening underlying conditions such as retinoblastoma.

Knowledge of the Retinopathy of Prematurity (ROP) demonstrated the biggest weaknesses of participants in this study. Almost three-quarters of them were aware of all the risks, while close to one-quarter of the respondents was not and the referral times varied greatly. About one-third of the participants selected the timing of ROP screening specified in the questionnaire. A study among healthcare professionals from Tabuk reported the gap in their knowledge of ROP screening and referral [3]. Among family physicians, the proportion of clinicians who recognized all the risk factors of ROP was relatively high compared to ophthalmologists. Other research has also found a variety of knowledge regarding pediatric eye-care [1]. Among clinicians with the experience of ≤10 years, 14.3% selected the specified referral and 35.7% answered "I don't know". The above-mentioned finding indicates that the ROP knowledge gaps among clinicians in Saudi Arabia might be present in various disciplines and could require a comprehensive approach to providing the education about ROP to all pediatricians.

In the area of refractive errors and strabismus, the level of knowledge was satisfactory although there was no universal awareness. Nearly one-third of clinicians were not aware that refractive errors may lead to the development of squint just like in a survey of national pediatricians and family medicine physicians [4,8]. It is known from the previous KAP study that there exist some misconceptions such as spontaneously curing of the squint and delayed referral. Moreover, although congenital glaucoma was referred properly and frequently enough, the recognition of the clinical features of the condition was not complete. The tearing was chosen by 34% of the respondents. Tearing may be presented in cases of congenital glaucoma along with other reasons for tearing in infants [14]. The subgroup analysis indicated that attending the workshop improved the level of knowledge about refractive error-induced squint (31% of respondents who didn't attend the workshop chose "I don't know"). One of the Delphi studies examined barriers to access to pediatric eye care in Saudi Arabia [15]. Astigmatism was the most frequently encountered refractive error in a referral eye clinic in Majmaah among 1,477 children in the age range of 3-15 years and strabismus and amblyopia were reported as well [16].

Painful red eye was another area with subgroup-related characteristics. The proportion of the recognition of uveitis and corneal abrasion was slightly higher in case of family physicians and specialty comparison was statistically inconclusive. The referral behavior was different since the participants who started their career earlier and not checking eyes preferred making urgent referral and those who were more experienced and checked eyes preferred the use of antibiotics before referral.

CONCLUSION

Together, our findings confirm the picture suggested by the national evidence base, which repeatedly demonstrates highly significant general knowledge of pediatric ophthalmology along with specific knowledge gaps in certain critical areas. Various sources show the persistence of ophthalmic knowledge gaps among front-line clinicians concerning sight-threatening pediatric eye diseases. Family physicians' inconsistent awareness and referral practice for such conditions was also reported [9]. Our findings fit this trend and emphasize the necessity of organized and standardized educational programs.

A number of recommendations can be provided based on the subgroup analysis results. Special training is required for pediatricians on the causes of painful red eye; ROP risk factors and referral timing; and leukocoria as a symptom indicating urgent assessment for retinoblastoma and other serious conditions. Clinicians with up to ten years of

professional experience should be trained on the indications of local management of neonatal conjunctivitis; the possible consequences of refractive errors (strabismus and development of amblyopia); and timing of referral of neonates born prematurely for ROP examination. According to the data of a multi-centre Saudi primary care study, there is a low availability of optometrists and variability in referrals to secondary care facilities [17]. With the support of the establishment of national standardized guidelines for shared care, family physicians could be used as a baseline for initiating shared care programs in various domains. Leukocoria, ROP and congenital glaucoma signs should be learned and basic eye exam skills (red reflex check, fixation and following and ocular alignment) should be acquired by all primary care providers. However, this data should be regarded as preliminary trends and recommendations should be confirmed in larger and properly powered studies.

The strength of this study is an extended sampling frame based on government database records, which includes both pediatricians and family medicine physicians as well as a previously published survey that enables comparisons to be made based on previously obtained results for Saudi Arabia. In addition, subgroup analysis allowed locating precisely areas of knowledge, providing a better understanding beyond simply overall scores. An evaluation of high-priority pediatric eye conditions enhanced the opportunity to assess competencies and identify gaps in competencies.

A self-administered survey can be biased by the influence of recall and social desirability biases and actual clinician practice could be different from reported responses. The voluntary character of the online participation can attract the clinicians with particular interest in pediatric ophthalmology. Local testing of the previously published survey had not been mentioned in the publication. Statistical power can be inadequate due to a lack of proper sample size calculation and relatively small number of samples, especially within subgroups. No multiple testing adjustment was done to minimize type I error risks when making subgroup comparisons. Effect sizes and confidence intervals were reported in a non-uniform way, so that it was impossible to estimate the magnitude and certainty of differences. Given the exploratory nature of the research, the results of subgroups should be viewed as hypotheses which should be validated by future research. Therefore, because of the limitation to one particular region in the study, the results may not apply to other areas of Saudi Arabia due to different training model and resources.

This study has revealed the strengths and gaps in knowledge of pediatric ophthalmology among pediatricians and family medicine physicians in Tabuk, Saudi Arabia. Immediate referral was commonly chosen. Gaps include the significance of leukocoria as a clinical finding; ROP timing of referral; squint associated with refractive errors; and the signs of congenital glaucoma. These findings help establish the topics for further education and assessment.

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