Knowledge of musculoskeletal complications in sickle cell disease among medical students at King Faisal University

Shaima AlMajed1*, Shahina Khan2

ABSTRACT

Background: Sickle cell disease (SCD) is an inherited condition with a clinical presentation that may involve multiple body systems. One of the main systems involved is the musculoskeletal system with complications including osteomyelitis, avascular necrosis, septic arthritis, osteoporosis, leg ulcers, and growth delay.

Methods: A cross-sectional study using a self-administered questionnaire was conducted at King Faisal University (KFU), at Al-Ahsa, Saudi Arabia. Statistical Package for the Social Sciences was used for the data analysis.

Results: There were 212 respondents who answered the questionnaire. Age groups were 18-20, 21-23, 24 and older with the majority (44.8%) being 21-23 years old. Female respondents were more than males with a percentage of 74.5% and 25.5% were males. Medical students in all different years in KFU participated in this study where the most participants (22.6%) were in their internship year. The prevalence of good knowledge was higher with 61.3% while average knowledge accounted for 32.5% and poor knowledge accounted for 6.1%.

Conclusion: The study concludes that 61.3% of medical students at KFU have good knowledge about SCD and its musculoskeletal complications.

Keywords: Sickle cell, musculoskeletal complications, medical students.

Introduction

Sickle cell disease (SCD) is an inherited blood disorder [1]. It was first discovered in the year 1910 by Herrick, whereas in Saudi Arabia, the first case was reported in the Eastern province in the year 1963 by Lehmann [2,3]. SCD consists of a group of genetic disorders with many clinical manifestations such as vaso-occlusive complications, chronic hemolysis, and increased susceptibility to infections [4]. This disease can lead to life threatening complications, as well as extensive organ damage in some patients [5,6]. The most common complications that require sickle cell patient to be hospitalized are painful vaso-occlusive crisis along with osteomyelitis [7-9]. Musculoskeletal involvement in SCD includes septic arthritis, osteoporosis, pathological fractures, dactylitis, avascular necrosis, and growth delay in children [10,11].

SCD is a common disease in Saudi Arabia and despite the numbers of the cases reported being decreased, the prevalence is considered higher compared to other countries [12,13]. The prevalence of SCD in the Eastern Province accounts for 145 cases per 10,000, while in the southern region it accounts for 24 cases per 10,000, western region for 12 cases per 10,000, and central region for 6 cases per 10,000 population [14]. The Saudi Premarital Screening Program estimates that 0.26% of the adult population are SCD trait carriers, and estimates that 4.2% have SCD [12]. The obstacles that Saudi Arabia faces in order to control SCD are challengeable. One of them is the high prevalence of consanguineous marriages in the country which accounts for 57.7% of the population [15]. Consanguineous marriage increases the risk of having genetic disorders, for this reason Saudi government is increasing their efforts in spreading awareness and educating people about this topic. One of the most important efforts is launching the Premarital Screening Program. This program is free and mandatory.
for all couples who are planning to get married. It is a successful program that helped in decreasing risky marriages by 60%. Another program is called the Genetic Counseling Program, and it has also shown to come up with successful outcomes [13]. There are many ways that help in preventing the disease. Spreading awareness and education for general population as well as healthcare professionals and students are important tools to achieve that. Therefore, assessing the level of knowledge among medical students about the disease and its complication is one step to help spread the awareness needed and provide good quality care for their patients in the future.

**Subjects and Methods**

This is a random cross-sectional study using a well-structured questionnaire conducted at King Faisal University (KFU), Al-Ahsa, Saudi Arabia. This study was conducted after obtaining ethical approval from higher authorities of KFU in Al-Ahsa, Saudi Arabia. Also, a proper permission has been received from the participants. Two hundred and twelve respondents participated in this study. The data was collected using a self-administrated questionnaire from March 12th until March 30th, 2020. Statistical Package for the Social Sciences (SPSS) was used for the data analysis. This study included any medical student who studies at KFU. Frequencies and percentages were measured. The relationship between dependent variables and independent factors has been calculated using chi-square test. \( p \)-value \( \leq 0.05 \) has been accepted as the significant level for the statistical tests performed. Measurement of level of knowledge about musculoskeletal complications in SCD was conducted. Based on the results, a score range from 0 to 15 has been generated by rating 15-13 as good knowledge, 12-11 as average knowledge and scores from 10 to 0 as poor knowledge.

**Results**

There were 212 respondents who answered the questionnaire. Age groups were 18-20, 21-23, 24 and older with the majority (44.8%) being 21-23 years old. Female respondents were more than males with a percentage of 74.5% being females and 25.5% being males. Medical students in all different years in KFU participated in this study with the most participants (22.6%) being in their internship year (Table 1).

**General Knowledge about SCD**

In this part, general knowledge of the respondents about SCD was tested. All 212 respondents agreed that SCD is an inherited condition and that it is a common disease in Saudi Arabia. Regarding RBCs having normal shape in sickle cell patients, 98.6% of the participants responded with false which reflects a good knowledge, while only 1.4% agreed with the statement. In life span of RBCs in SCD 17% of the respondents answered 120 days, and 21.2% answered 10-20 days while the majority of them that account for 61.8% answered 60 days. Regarding the statement that SCD can develop life-threatening complications, all the 212 respondents agreed with it. When asking about SCD complications, 5.7% chose acute chest syndrome, 6.1% agreed on stroke, 4.7% answered osteomyelitis while 83.5% chose all of the above option (Table 2).

**Knowledge about Musculoskeletal Complications in SCD**

In this part, knowledge about musculoskeletal complications in sickle cell patients was tested among medical students. About 98.6% of the respondents agreed that sickle cell anemia leads to bone pain and only 1.4% disagreed with the statement. Regarding swelling of hands and feet not being related to sickle cell anemia, 9.9% agreed with the statement while the majority (90.1%) disagreed with the statement. The next statement was that sickle cell anemia can inhibit a child’s development and most of the respondents (88.2%) agreed, while 11.8% disagreed. In the next question, 17.9% of the respondents think that patients with SCD have the same bone density with their age match in general population, while 82.1% think that SCD have lower bone density. For the part that is affected by osteomyelitis in sickle cell patient’s femur, tibia or humorous, 61.3% answered diaphysis location, and 38.7% went with metaphyseal location. The next question was about joint spaces feature on X-ray in sickle cell patients who have arthritis, as most of the respondents (77.4%) answered with narrowed while 22.6% think that joint spaces are widened. Majority of the respondents (97.2%) agreed that the diagnosis of septic arthritis in SCD can be confirmed by a culture of joint aspiration, while 2.8% disagreed. When asked about how to detect early changes of avascular necrosis in SCD patients 14.6% of the respondents chose X-ray while the majority (85.4%) agreed on MRI. Regarding the statement that surgical intervention is helpful in preventing progression.
of avascular necrosis, 89.6% of the respondents agreed that it is helpful while 10.4% disagreed (Table 3).

**Level of Knowledge**

Level of knowledge was rated according to the respondents’ answers. The total was 15, therefore, scores from 15 to 13 were reflected as good knowledge. Scores from 12 to 11 were rated as average and scores from 10 or less were rated as poor knowledge. The prevalence of good knowledge was higher with 61.3% while average knowledge accounted for 32.5% and poor knowledge accounted for 6.1% (Figure 1).

**Discussion**

SCD has a multisystem involvement. One of the main systems involved is the musculoskeletal system. Basic knowledge of sickle cell anemia and its musculoskeletal complications among medical students is mandatory so the purpose of this study was to assess the knowledge of musculoskeletal complications in SCD among medical

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Table 2. General knowledge about SCD.

<table>
<thead>
<tr>
<th>Question/statement</th>
<th>Number and percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCD is an inherited condition</td>
<td>True 212 (100%)</td>
</tr>
<tr>
<td></td>
<td>False 0</td>
</tr>
<tr>
<td>SCD is common in Saudi Arabia</td>
<td>True 212 (100%)</td>
</tr>
<tr>
<td></td>
<td>False 0</td>
</tr>
<tr>
<td>In sickle cell patients, red blood cells have normal shapes</td>
<td>True 3 (1.4%)</td>
</tr>
<tr>
<td></td>
<td>False 209 (98.6%)</td>
</tr>
<tr>
<td>The life span of RBCs in SCD is</td>
<td>10-20 days 45 (21.2%)</td>
</tr>
<tr>
<td></td>
<td>120 days 36 (17.0%)</td>
</tr>
<tr>
<td></td>
<td>60 days 131 (61.8%)</td>
</tr>
<tr>
<td>SCD can develop life-threatening complications</td>
<td>True 212 (100%)</td>
</tr>
<tr>
<td></td>
<td>False 0</td>
</tr>
<tr>
<td>One of SCD complications is</td>
<td>Acute chest syndrome (5.7%)</td>
</tr>
<tr>
<td></td>
<td>Stroke (6.1%)</td>
</tr>
<tr>
<td></td>
<td>Osteomyelitis (4.7%)</td>
</tr>
<tr>
<td></td>
<td>All of the above (83.5%)</td>
</tr>
</tbody>
</table>

Table 3. Knowledge about musculoskeletal complications in SCD.

<table>
<thead>
<tr>
<th>Question/Statement</th>
<th>Answers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sickle cell anemia leads to bone pain</td>
<td>True 209 (98.6%)</td>
<td>False 3 (1.4%)</td>
</tr>
<tr>
<td>Swelling of hands and feet has nothing to do with sickle cell anemia</td>
<td>True 21 (9.9%)</td>
<td>False 191 (90.1%)</td>
</tr>
<tr>
<td>Sickle cell anemia may inhibit the child’s development</td>
<td>True 187 (88.2%)</td>
<td>False 25 (11.8%)</td>
</tr>
<tr>
<td>Bone density in patients with SCD compared with age match in general population</td>
<td>Same bone density 38 (17.9%)</td>
<td>Lower bone density 174 (82.1%)</td>
</tr>
<tr>
<td>Osteomyelitis in sickle cell patients commonly affects the femur, tibia, or humerus at which part</td>
<td>Diaphysis location 130 (61.3%)</td>
<td>Metaphyseal location 82 (38.7%)</td>
</tr>
<tr>
<td>On x-ray, the joint spaces in sickle cell patients with arthritis are</td>
<td>Narrowed 164 (77.4%)</td>
<td>Widened 48 (22.6%)</td>
</tr>
<tr>
<td>Diagnosis of septic arthritis in SCD can be confirmed by culture of joint aspiration</td>
<td>True 206 (97.2%)</td>
<td>False 6 (2.8%)</td>
</tr>
<tr>
<td>Early changes of avascular necrosis in SCD patients can be detected by</td>
<td>X-ray 31 (14.6%)</td>
<td>MRI 181 (85.4%)</td>
</tr>
<tr>
<td>Surgical intervention is helpful to prevent the progression of avascular necrosis</td>
<td>True 190 (89.6%)</td>
<td>False 22 (10.4%)</td>
</tr>
</tbody>
</table>
students at KFU. The findings of this study show good knowledge of the participants toward the topic and it accounted for 130 (61.3%) while average knowledge accounted for 69 (32.5%) and poor knowledge accounted for 13 (6.1%). In the first section of the survey, general knowledge about SCD was tested.

All 100% of the respondents agreed that SCD is an inherited condition which reflects a good knowledge about the basics of the disease. Similar observation was found in a study conducted by Treadwell et al. [16] where majority of the respondents believed that SCD is an inherited condition. For the second statement, 100% of the respondents agreed that SCD is common in Saudi Arabia. The prevalence of SCD in Saudi Arabia is considered high, according to different parts of the country it is as follows; in Eastern Province the prevalence is 145 cases per 10,000, while in the southern region it is 24 cases per 10,000, western region is 12 cases per 10,000, and in central region it is 6 cases per 10,000 population [14]. Regarding if RBCs in SCD have normal shape, 98.6% of the participants responded with false which reflects a good knowledge, while only 1.4% agreed with the statement. In SCD the life span of RBCs is 10-20 days. In this study, 21.2% answered correctly while the majority that accounts for 61.8% answered 60 days and 17% answered 120 days. The life span of normal red blood cells is 90-120 days, whereas sickle cells have a span of 10-20 days as a consequence of spleen sequestration due to the cells deformed shapes [17]. Regarding the statement that SCD can develop life-threatening complications, 100% of the respondents agreed with it which reflects a good knowledge. When asking about SCD complications, 5.7% chose acute chest syndrome, 6.1% agreed on stroke, 4.7% answered osteomyelitis while the majority that is 83.5% chose all of the above option which is the correct answer. In a study conducted by Obourne [18] about SCD awareness amongst college students in 2011, 84.9% of the respondents answered all of the above which is a similar outcome and reflects a good knowledge. About 98.6% of the respondents agreed that sickle cell anemia leads to bone pain and only 1.4% disagreed with the statement. In a study conducted by Ogandị [19] that was done to evaluate the general knowledge of SCD among 334 university students in Texas, 63% of students were able to answer SCD symptoms related questions correctly. Regarding the statement that says swelling of hands and feet has nothing to do with SCD, 9.9% agreed with the it while the majority (90.1%) disagreed. The knowledge about one of SCD features that is dactylitis also known as hand and foot syndrome was tested in this statement. According to the results, majority of the respondents have showed good knowledge by declaring that swelling of hands and feet does have a relationship with SCD. In a study conducted by Lamia Amin to assess knowledge and misconceptions on SCD among students from different colleges of Imam Abdulrahman Bin Faisal University in 2018, only 52% of the respondents answered this correctly which approves that medical students have better knowledge about the disease [20]. The next statement was that sickle cell anemia can inhibit a child’s development and most of the respondents (88.2%) agreed, while 11.8% disagreed. Similar results were found in the previously mentioned study that was conducted by Lamia Amin in 2018, where 79% of the respondents answered correctly. According to National Heart, Blood and Lung Institute, a child’s growth is affected in SCD due to poor nutrition, chronic anemia, and fatigue [21]. In the next question, 17.9% of the respondents believe that patients with SCD have the same bone density with their age match in general population while the majority that accounted for 82.1% believe that sickle cell patients have lower bone density. According to a study done by Amrolia et al. [22], sickle cell patients have shown to have lower bone density in comparison with their unaffected peers. Therefore, majority of the respondents in this study showed a good knowledge about this part. In the next question, knowledge about osteomyelitis in sickle cell patients was tested by asking which part of the femur, tibia, or humerus is most commonly affected in SCD. Around 61.3% of the respondents chose diaphysis location which is the correct answer while 38.7% went with metaphyseal location. In this part, some lack of knowledge is observed. As a study that was done by Stark et al. [23] found that osteomyelitis in SCD mostly affects the diaphysis part of long bones, whereas in non-sickle cell people it mostly affects the metaphyseal part [23]. The next question was about joint spaces on X-ray in sickle cell patients who have arthritis, as most of the respondents (77.4%) answered with narrowed spaces, while 22.6% believe that joint spaces are widened. According to a study, arthritis in sickle cell patients’ X-ray findings may include bone erosions, osteopenia, synovitis, as well as narrowed joint spaces [17]. Next, respondents were asked if septic arthritis can be confirmed by a culture of joint aspiration. Majority of them that accounted for 97.2% agreed with the statement,
while 2.8% disagreed. A study that was done by Almeida A, and Roberts stated that septic arthritis can be confirmed by a culture of joint aspiration. Therefore, the majority of the respondents answered this question correctly and it shows a good level of knowledge [24]. When asked about how to detect early changes of avascular necrosis in SCD patients 14.6% of the respondents chose X-ray, while the majority that accounted for 85.4% chose MRI. It is worth mentioning that the majority have a good knowledge about the diagnosis of the complications. According to Rees et al. [25], to diagnose and grade avascular necrosis in early stages, MRI can be used. Regarding the last statement that surgical intervention is helpful in preventing progression of avascular necrosis, 89.6% of the respondents agreed that it is helpful which is the correct answer while 10.4% disagreed. In agreement with the statement a study that was done by Hernigou et al. [26] reported that the asymptomatic avascular necrosis that is left untreated in sickle cell patients has a high potential to progress and collapse so early surgical intervention can help delay the progression. Results of this study showed a good knowledge of participants about the subject with 61.3%, while average knowledge accounted for 32.5% of the participants and poor knowledge accounted for 6.1%.

Conclusion
This study concludes that medical students at KFU have good knowledge about SCD and its musculoskeletal complications. Average and poor knowledge reflect differences between students’ perceptions. It is worth to mention that the knowledge grows better with education as well as interaction with patients suffering from the disease so aspiration to have a good knowledge comes with a lot of effort, experience, and time.

List of Abbreviations
KFU  King Faisal University
SCD  Sickle cell disease
SPSS  Statistical Package for the Social Sciences

Conflict of interest
The authors declare that there is no conflict of interest regarding the publication of this article.

Funding
None.

Consent to participate
Informed consent was obtained from participants.

Ethical approval
This study was conducted after obtaining ethical approval from higher authorities of King Faisal University in Al-Ahsa, Saudi Arabia.

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