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Prevalent practice of swaddling and its association with developmental dysplasia of hip

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ABSTRACT

Background: Traditional swaddling is widely used in neonates which imply restrictive mobilization of the lower limbs by extending and addicting the hip forcefully. It has been proven the association between incorrect methods of swaddling with an increased risk of Developmental Dysplasia of Hip (DDH). This study aims to determine the prevalent practice of swaddling among mothers in the Eastern province of Saudi Arabia. *Methods:* This was an observation cross-sectional conducted among 3166 Saudi mothers in the eastern province, Saudi Arabia during the period of 1/10/2021 to 26/2/2022. A mother who is 18 years and above and has a child was included in the stud. A self-structures validated questionnaire was used. *Results:* This study involved 3166 mothers with a mean age of 36.9 ± 11.7 years old and more than half of the 61% had a high level of education. Seven percentage of participant had a child with DDH that was diagnosed during the first 6 months of age. Only 37% showed good knowledge about DDH level its complications. An exact 64.7% acknowledged that Swaddling is a predisposing factor for DDH but only 27.1% had fair knowledge regarding swaddling. Most of the participants 86% learned how to swaddle from their families. Mothers with a high level of education, having a child with DDH, and being health care providers had proper prevalent of practicing swaddling ($P < 0.05$). *Conclusion:* Hip-safe techniques of swaddling are considered as a modifiable risk factor, being familiar with this association is essential to eliminate the risk of it.

Keywords: developmental dysplasia of the hip (DDH), swaddling, hip-safe, risk factors, Saudi Arabia, knowledge.

1. INTRODUCTION

Developmental dysplasia of the hip (DDH) is a disease that includes abnormal hip developments that occur at an early age of life (Ortiz et al., 2012). The clinical presentation of DDH is varying from neonatal hip instability,

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acetabular dysplasia without hip dislocation to complete open hip dislocation. The cause of DDH is multifactorial. They are several risk factors that increase the risk of DDH such as female gender, first pregnancy, breech presentation, positive family history, oligohydramnios, improper swaddling of the newborn (with the lower limb in adduction and extension), ethnicity, and coexistence of associated orthopedic conditions such as torticollis and foot deformities (Ortiz et al., 2012; Stevenson et al., 2009; Li et al., 2017; Panagiotopoulou et al., 2012; Eltyeb et al., 2022).

Ultrasound (US) of the hip is considered the definitive method to diagnose DDH in the first six months of life (Ömeroğlu et al., 2019). The screening of DDH is considered controversial because there are no agreed guidelines or standards internationally (Paton et al., 2017). The screening is done by clinical (Ortolani and Barlow maneuvers) and or ultrasound sonography of the hip joint at the early age of life. The prognosis of DDH depends on the time of diagnosis and treatment that range from nonsurgical (Pavlik harness) to the surgical approach (Weinstein et al., 2018). The importance of early recognition and treatment of DDH is to avoid complications if left untreated such as degenerative hip which eventually leads to early arthritis of the hip, and the need for surgery and possible post-surgical complications that may occur such as osteonecrosis, residual dysplasia, and recurrence of dislocation (Alshahrani et al., 2018). The incidence of DDH without risk factors is approximately 11.5/1,000 live births, and with risk factors for each gender separately approximately 4.1/1,000 for boys to 19/1,000 for girls, indicating that for each male patient, there are 4 or 5 female patients (Goiano et al., 2020). The incidence of DDH could vary from one country to another based on the existence of modifiable risk factors.

Swaddling is a risk factor of DDH if done improperly. Unsafe swaddling is defined as straightening of legs and adduction of the hip while allowing flexion and abduction of the hip is hip-safe swaddling and has no harmful effect on the hip joint (Pinto et al., 2020). DDH is uncommon in China and Nigeria and one of the reasons for this is because the hip is hold on to an abduction position in swaddling (Mirdad et al., 2002; Almahdi et al., 2017). Swaddling in Saudi Arabia is so common, thus, the incidence of DDH is common ranging between 3.8 and 36.5 cases per 1,000 live births based on different cities (Mirdad et al., 2002; Khan et al., 1992; Fowler et al., 1995). This shows the significant relationship between DDH and the importance of proper technique of swaddling. In Qatar and Japan, increasing awareness of proper swaddling shows a remarkable reduction of DDH incidence from 20% to 6% and from 5% to 0.4%, respectively.

Since swaddling is a traditional practice in Saudi Arabia and it's an effect on increasing the risk of DDH, this study aims to assess the knowledge and attitude of Saudi mothers in the eastern province, Saudi Arabia about DDH and its significant relationship to unsafe swaddling. This study may help in decreasing the incidence of DDH in Saudi Arabia by increasing the awareness of the Saudi mother's population toward the proper swaddling of new babies.

2. SUBJECTS AND METHODS

This is a qualitative cross-sectional anonymous questionnaire-based study that was performed among 3166 Saudi mothers in the eastern province, Saudi Arabia. A systemic random sampling method was used for choosing the participants. Saudi mothers whose age 18 years and above was included in the study. Non-Saudi mothers, mothers whose ages are less than 18 and females who do not have a child and males were excluded from this study.

Ethical approval was obtained from the Institutional Review Board of King Fahad Hospital-Hofuf via letter-number 43-EP-2021, dated 14/10/2021. Informed consent was obtained from all participants. Collection of data was done during the period of 1/10/2021 to 31/1/2022. A self-structure validated questionnaire used in this study was used. Sections of the questionnaire cover the sociodemographic data including age, gender, occupation, marital status, nationality, level of education, and income moreover, family history, knowledge, and awareness about developmental dysplasia of the hip and its relationship toward swaddling.

Data analysis

After data were extracted, it was revised, coded, and fed to statistical software IBM SPSS version 22 (SPSS, Inc. Chicago, IL). All statistical analysis was done using two-tailed tests. P-value less than 0.05 were statistically significant. For knowledge and awareness items, each right answer was worth one point, and a total sum of the discrete scores of the separate items included general DDH and swaddling knowledge. Mothers with less than 60% of the total score were regarded to have bad knowledge, while those with 60% or more were judged to have high knowledge. All variables, including mothers' socio-demographic data and several children, DDH related data and history, and source of DDH information, were subjected to descriptive analysis based on frequency and percent distribution. In addition, frequency tables depicted mothers' knowledge and perceptions of DDH and swaddling, as well as associated problems. Cross tabulation was utilized to analyze the distribution of mothers' DDH knowledge

based on their data and disease history. For tiny frequency distributions, the Pearson chi-square test and exact probability test were used to examine relationships.

3. RESULTS

A total of 3166 mothers fulfilling the eligibility criteria completed the study questionnaire. The mother's ages ranged from 18 to more than 45 years with a mean age of 36.9 ± 11.7 years old. The exact 91% of the mothers were married while 9% were divorced/widows. As for the number of children, 32.2% had 1-2 children, 38.2% had 3-4 children, and 29.6% had 5 children or more. Considering educational level, 61.4% had a university level of education / above while 28% had a secondary level of education. A monthly income of less than 5000 SR was reported among 48.7% of the mothers, while 9.2% had a monthly income of more than 15000 SR (Table 1).

Table 1 Socio-demographic data of study Saudi mothers in eastern province, Saudi Arabia

Socio-demographic data	No	%
Age in years		
18-25	341	10.8%
26-35	1035	32.7%
36-45	1116	35.2%
> 45	674	21.3%
Marital status		
Married	2880	91.0%
Divorced / widow	286	9.0%
Number of children		
1-2	1020	32.2%
3-4	1208	38.2%
5+	938	29.6%
Educational level		
Below secondary	334	10.5%
Secondary	887	28.0%
University / above	1945	61.4%
Job title		
Not employed	1954	61.7%
Non-health care worker / student	887	28.0%
Health care worker / student	325	10.3%
Monthly income		
< 5000 SR	1541	48.7%
5000-10000 SR	773	24.4%
1000-15000 SR	562	17.8%
> 15000 SR	290	9.2%

Table 2 shows the information about DDH among Saudi mothers in the eastern province, Saudi Arabia. A total of 64.2% of the study mothers reported that they heard about DDH. The most reported source of information regarding DDH was social media (31.8%), followed by friends (18.3%), affected family members (17.5%), and 31.7% had no specific source. Exact of 7% of the mother had a child diagnosed with DDH. The age of diagnosis was at the first 6 months of age among 61.7% of the affected children, and 6-12 months at 21.2%, while 3.6% were diagnosed after 2 years of age.

Table 2 Information about DDH among Saudi mothers in eastern province, Saudi Arabia

DDH data	No	%
Have you heard about DDH?		
Yes	2033	64.2%
No	1133	35.8%
Source of information		
Affected family member	554	17.5%
Doctor	313	9.9%
Social media	1006	31.8%
Friend	579	18.3%
Study	23	.7%
Others	91	2.9%
No source	1005	31.7%
Has any one of your children been diagnosed with DDH?		
Yes	222	7.0%
No	2944	93.0%
If yes, what was the age at the time of diagnosis?		
< 6 months	137	61.7%
6-12 months	47	21.2%
1-2 years	30	13.5%
> 2 years	8	3.6%

Table 3 shows Mothers' knowledge regarding DDH and its complications, eastern province, Saudi Arabia. Exact of 86.6% of the study mothers know that treatment at an early age is better than waiting, 57.7% know that surgical treatment is the preferred treatment method if the patient was diagnosed at a later age while 54.6% of them know that non-surgical treatment is the preferred treatment method if the patient was diagnosed at an early age. Also, 53.5% think the disease can be prevented, 46.3% think that a patient with congenital hip dislocation can walk. As for complications of neglected DDH, the most known was Continuous lameness (44.1%), followed by uneven feet (43.5%), Friction and wear in a dislocated hip (39.8%), Pain at the hip (39.1%), and Inability to walk (34%). Only 37.5% think that the outcome of the disease after the treatment will be a complete cure.

Table 3 Mothers' knowledge regarding DDH and its complications, eastern province, Saudi Arabia

Knowledge items	No	%
Do you think the disease can be prevented?		
Yes	1695	53.5%
No	227	7.2%
I don't know	1244	39.3%
Do you think that a patient with a congenital hip dislocation can walk?		
Yes	1466	46.3%
No	486	15.4%
I don't know	1214	38.3%
What is the preferred treatment method if the patient was diagnosed at an early age?		
Non-surgical treatment	1729	54.6%

Surgical treatment	599	18.9%
I don't know	838	26.5%
What is the preferred treatment method if the patient was diagnosed at a later age?		
Surgical treatment	1827	57.7%
Non-surgical treatment	410	13.0%
I don't know	929	29.3%
What do you expect the outcome of the disease after the treatment?		
Complete cure	1188	37.5%
Partial cure	1094	34.6%
I don't know	884	27.9%
Do you think that treatment at an early age is better than waiting?		
Yes	2741	86.6%
No	45	1.4%
I don't know	380	12.0%
In case of neglecting the treatment, what are the complications do you expect to occur?		
Friction and wear in a dislocated hip	1259	39.8%
Uneven feet	1377	43.5%
Inability to walk	1075	34.0%
Continuous lameness	1395	44.1%
Pain at the hip	1238	39.1%
Others	71	2.2%
I don't know	674	21.3%

Figure 1 shows the overall knowledge regarding DDH among Saudi mothers in the eastern province, Saudi Arabia. A total of 1173 (37%) mothers had a good knowledge level regarding DDH and its related complications versus 1993 (63%) had poor knowledge level. Table 4 shows mothers' knowledge regarding Swaddling and its complications, eastern province, Saudi Arabia. A total of 43.8% of the study mothers know the correct way of swaddling, 64.7% know that Swaddling can cause damage to the bones and joints of the child, 38.9% know that Swaddling can lead to dislocation of the hip joint. Only 23.7% think that DDH is less common in countries where swaddling is not used.

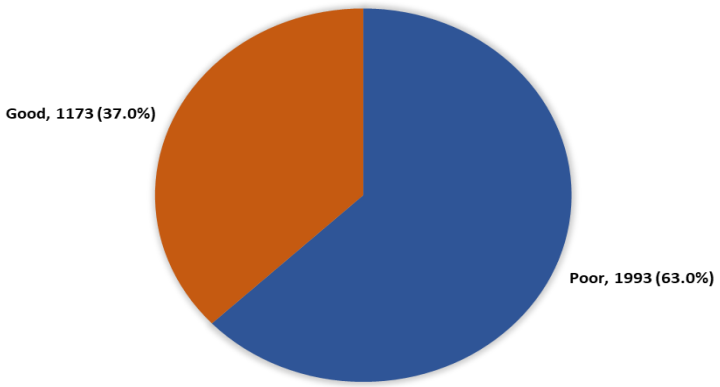

Figure 1 Overall knowledge regarding DDH among Saudi mothers in eastern province, Saudi Arabia

Table 4 Mothers' knowledge regarding Swaddling and its complications, eastern province, Saudi Arabia

Knowledge items	No	%
What is the correct way to swaddle?		
Tight over the upper limb and loose over the lower limb allowing the flexion and movement of the legs	1385	43.8%
The legs must be straight and near each other	955	30.2%
Using band to prevent the movement of upper and lower limbs completely	532	16.8%
I don't know	293	9.3%
Swaddling can cause damage to the bones and joints of the child?		
Yes	2047	64.7%
No	526	16.6%
I don't know	592	18.7%
Swaddling can lead to dislocation of the hip joint		
Yes	1232	38.9%
No	752	23.8%
I don't know	1181	37.3%
DDH is less common in countries where swaddling is not used		
Yes	751	23.7%
No	695	22.0%
I don't know	1719	54.3%

Figure 2 Overall knowledge regarding Swaddling among Saudi mothers in the eastern province, Saudi Arabia. Exact of 859 (27.1%) had good knowledge regarding swaddling but 2307 (72.9%) had poor knowledge level. Table 5 shows Mothers' practice regarding Swaddling and its effect, eastern province, Saudi Arabia. An exact 90.3% of the study mothers used swaddling for their children or one of their relatives. Swaddling was for 3 months among 21.9% and 2 months among 21.7% of them. Also, 17.9% used swaddling for 4 months and 16.5% for more than 4 months. A total of 16.6% of mothers reported that they will use swaddling even it may cause harm to their baby. The family was the main model to learn for swaddling among mothers (86.1%), followed by the health care provider (4.4%), and friends (3.7%).

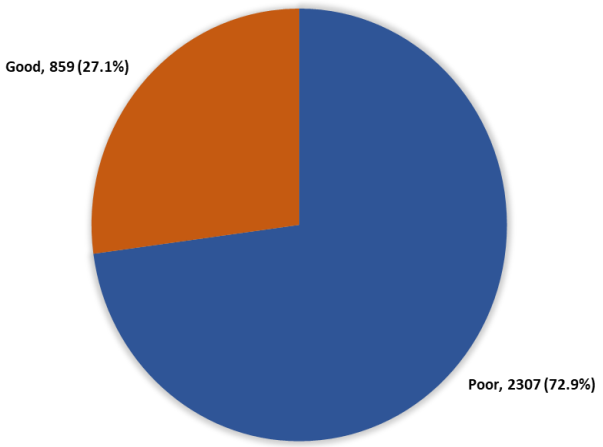

Figure 2 Overall knowledge regarding Swaddling among Saudi mothers in eastern province, Saudi Arabia

Table 5 Mothers' practice regarding Swaddling and its effect, eastern province, Saudi Arabia

Practice	No	%
Did you use swaddling for your children or one of your relatives?		
Yes	2858	90.3%
No	308	9.7%
What was the duration of swaddling?		
< 1 month	212	7.4%
1 month	416	14.6%
2 months	621	21.7%
3 months	627	21.9%
4 months	511	17.9%
> 4 months	471	16.5%
If you know that swaddling can cause harm to your baby, will you use it?		
Yes	524	16.6%
No	2641	83.4%
I learned the way to Swaddle from		
Family	2460	86.1%
Friends	107	3.7%
Social media	93	3.3%
Health care provider	127	4.4%
Others	11	.4%
None	60	2.1%

Table 6 shows the distribution of mother knowledge regarding DDH by their socio-demographic data. The exact 38.2% of married mothers had a good knowledge level regarding DDH compared to 25.5% of the divorced / widow group with recorded statistical significance (P=.001). Also, 42.3% of highly educated mothers had good knowledge versus 20.1% of those with below secondary level of education (P=.001). Good knowledge regarding DDH was detected among 52% of health care workers/ students compared to 34.6% of unemployed mothers (P=.001). Also, 46.5% of mothers who heard about DDH had a good knowledge level in comparison to 20% of others who did not (P=.001). Additionally, 45% of a mother with a child diagnosed with DDH had a good knowledge level about the diseases compared to 36.4% of those without (P=.011).

Table 6 Distribution of mother knowledge regarding DDH by their socio-demographic data

Socio-demographic data	DDH knowledge level				p-value
	Poor		Good		
	No	%	No	%	
Age in years					
18-25	204	59.8%	137	40.2%	.057
26-35	638	61.6%	397	38.4%	
36-45	698	62.5%	418	37.5%	

> 45	453	67.2%	221	32.8%	
Marital status					
Married	1780	61.8%	1100	38.2%	.001*
Divorced / widow	213	74.5%	73	25.5%	
Number of children					
1-2	610	59.8%	410	40.2%	.056
3-4	782	64.7%	426	35.3%	
5+	601	64.1%	337	35.9%	
Educational level					
Below secondary	267	79.9%	67	20.1%	.001*
Secondary	604	68.1%	283	31.9%	
University / above	1122	57.7%	823	42.3%	
Job title					
Not employed	1277	65.4%	677	34.6%	.001*
Non-health care worker / student	560	63.1%	327	36.9%	
Health care worker / student	156	48.0%	169	52.0%	
Have you heard about DDH?					
Yes	1087	53.5%	946	46.5%	.001*
No	906	80.0%	227	20.0%	
Has any one of your children been diagnosed with DDH?					.011*
Yes	122	55.0%	100	45.0%	
No	1871	63.6%	1073	36.4%	

P: Pearson X^2 test
** P < 0.05 (significant)*

4. DISCUSSION

Developmental dysplasia of the hip (DDH) is featured by an unstable femoral head within the acetabular socket where it should be (McCarthy et al., 2005). This abnormality causes dislocation/subluxation of the hip joint (Gross et al., 1982). The precise etiology of DDH is still unclear but it is supposed to be a 'multifactorial trait' where several factors are drawn in (Gross et al., 1982). The frequency of DDH differs according to several factors. One in every 1000 children is born with a dislocated hip, and 10 in every 1000 will develop hip subluxation (Bialik et al., 1999; Pollet et al., 2017; Dezateux et al., 2007). The main determinants of DDH embrace abnormal intrauterine presentation such as breech presentation, female child, positive family history, firstborn status, and oligohydramnios (Chan et al., 1997). The current study aims to investigate Saudi mothers' knowledge and attitudes regarding DDH and its considerable association to hazardous swaddling in the eastern region of Saudi Arabia.

In terms of DDH, the study found that two-thirds of the study moms were aware of the condition, with social media being the most often cited source of knowledge, followed by friends and afflicted individuals. Physicians were mentioned as a source of knowledge by nearly one out of every ten moms, indicating a flaw in their position as a reliable source that should play a larger role. DDH was reported among only 7% of parents' children where two-thirds of them were diagnosed at their first 6 months of life

and one-fifth at their first year. The incidence of DDH in the southern region of Saudi Arabia was about 3.5 per 1000 live births; therefore, it is a challenging health disorder for pediatric orthopedic surgeons (Loder et al., 2011). Sadat-Ali (2020) conducted a systematic review including10 studies in Saudi Arabia and found that the average incidence of DDH in Saudi Arabia was 10.46/1000. The majority of cases presented after 12 months of age. The right side was affected in 532 (27.2%) affected, 734 (37.6%) were left side and 687 (35.2%) infants were affected bilaterally (Sadat-Ali, 2020).

In terms of mothers' awareness of DDH, the study found that more than one-third of the moms had a solid understanding of DDH. More specifically, more than three-quarters of the study mothers believe that early treatment is preferable to waiting, and more than half believe that surgical treatment is the preferred treatment method if the patient was diagnosed later in life, and non-surgical treatment is the preferred treatment method if the patient was diagnosed early in life. Furthermore, slightly more than half of the moms believe the condition may be avoided, but fewer than half believe a patient with congenital hip dislocation can walk. As for complications of neglected DDH, the most known was Continuous lameness, followed by uneven feet, Friction and wear in a dislocated hip, Pain at the hip, and Inability to walk (34%). About one-third thinks that the outcome of the disease after the treatment will be a complete cure. Married female with high education levels, health care professionals who had heard of the condition, and people who had a child with DDH all had higher knowledge levels.

Alqarni (2021) discovered that about 5% of Saudi Arabian women reported having a child with DDH. Additionally, almost one-third of the female participants had a strong understanding of DDH, and 65.6% of pregnant women were aware of it. Additionally, 43.5 percent of the study's female participants reported knowing about DDH treatment options, and 39.1 percent reported knowing about the consequences linked to the condition (Alqarni et al., 2021). Relatives and friends were the most often stated source of information (44.3 percent), followed by social media (11.9 %) and education and job (11.9 %) (7.1 %). Almahdi (2017) discovered that moms' awareness among females in Saudi Arabia is inadequate (Almahdi et al., 2017). Shaw (2016) also found that females had a low degree of DDH awareness. Furthermore, a lack of knowledge about treatment options frequently leads to late diagnosis, which is a major health concern since it raises the likelihood of surgery and related morbidity (Shaw et al., 2016).

The present study found that around one-fifth of the study moms were knowledgeable with swaddling. Less than half of the study moms knew how to swaddle correctly, but two-thirds are aware that swaddling can harm a child's bones and joints. More than one-third is aware that swaddling can result in hip dislocation, and around one-fifth believe that DDH is less likely in nations where swaddling is not practiced. When it comes to moms' swaddling habits, the great majority of them utilized it for their children or a relative. In addition, 17.9 % utilized swaddling for 4 months or less, while 16.5 % used it for infants beyond 4 months. Sixteen percent of mothers would still swaddle their infants even if it would hurt them.

Among women, the family served as the primary example for learning how to swaddle, followed by a healthcare professional and friends. 91.3 percent of the moms in the research used swaddling, according to (Almahdi et al., 2017). Only 4% of women learnt how to swaddle from healthcare professionals; the rest learned how to swaddle from family or friends. More than 75% of the participants overlook the harmful consequences of swaddling on kids' hips, and about 63% are unaware of the proper swaddling technique. Even though parents are aware that swaddling might be harmful to their children, just 7% of them still practice it.

5. CONCLUSIONS

The current study found that mothers' understanding of DDH, swaddling, and practice was inadequate. The mothers' understanding of illness nature, treatment, causes, consequences, and risk factors was inadequate. Health-care workers were not the primary source of knowledge about the condition or the swaddling technique. Higher knowledge levels were linked to higher education, illness experience, and being a health care practitioner. To reach all prospective moms, health-care practitioners should describe the effects of swaddling and show the method for hip-friendly swaddling during prenatal and postnatal care, as well as in the media. Improving community members' understanding of DDH, particularly pregnant women, is very important because it is a preventable disease.

Author contribution

Hussain A. Al Ghadeer: Writing the proposal, review of the manuscript; Habib Y. Aldabbab, Naif AlHammam, Mohammed Al Barqi, Abdulrahman A. Alnaim, Zainab H. Al Alawi, Hassan H. AlAmer, Sajidah H. AlKhawajah, Maram Alqattan, Mohammed H. Alalawi, Baqer A. Aldhneen, Mohammed A. AlDabbab, Batla S. Albattat: data collection, data entry and analysis with review of the manuscript

All authors of this study were equally involved in the design of the study, data collection, analysis, drafting and correction of the final draft, and the author was responsible for the proper implementation of the study at all stages. There is no author whose name is not listed in the authors list.

All authors declare the following:

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All authors have declared that no financial support was received from any organization for the submitted work.

Financial relationships

All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other relationships

All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work

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Author contribution

All authors of this study were equally involved in the design of the study, data collection, analysis, drafting and correction of the final draft, and the author was responsible for the proper implementation of the study

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Ethical approval

Ethical approval was obtained from the Institutional Review Board of King Fahad Hospital-Hofuf via letter-number 43-EP-2021.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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