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ETHICAL ASPECTS OF AGE ESTIMATION FOR FORENSIC PURPOSES IN SAUDI ARABIA

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Abstract: In forensic and legal contexts, an assessment of skeletal maturation is required to predict the chronological age in certain circumstances in which the chronological age is undocumented or unable to be proven. Carrying such medical examinations will always pose an ethical concern, especially in cases of assessing sexual maturity as well as examinations involving ionizing radiation. The cultural and religious barriers are also discussed concerning the ethical standards set in Saudi Arabia. Several ethical issues concerning age estimation examinations including issues related to consent forms, privacy, and radiation hazards have been documented. While ethical issues regarding radiation hazards are more likely to be overcome by introducing other imaging modalities without radiation hazards, ethics related to consent forms and privacy are still to be improved.

Key words: skeletal maturation, age estimation, ethical principles, radiation hazards

Aspectos éticos de la estimación de la edad para propósitos forenses en Arabia Saudita

Resumen: En contextos forenses y legales, se requiere la evaluación de la maduración del esqueleto para predecir la edad cronológica en ciertas circunstancias en que la edad cronológica no está documentada o no es posible de probar. Realizar tales exámenes médicos siempre significa una preocupación ética, especialmente en casos de evaluación de madurez sexual así como en exámenes que involucran radiaciones ionizantes. Se discuten también las barreras culturales y religiosas relacionadas con el contexto de estándares éticos en Arabia Saudita. Entre los varios temas éticos relacionados con la estimación de la edad, se documentan temas relacionados con los formularios de consentimiento, privacidad y riesgos de radiación. Mientras que los temas éticos relacionados con riesgos de radiación pueden ser resueltos al introducir otras modalidades de examen sin radiación, los problemas éticos relacionados con los formularios de consentimiento y privacidad todavía necesitan mejorarse.

Palabras clave: maduración del esqueleto, estimación de la edad, principios éticos, riesgos de radiación

Aspectos éticos da estimativa de idade para propósitos forenses na Arábia Saudita

Resumo: Em contextos forenses e legais, uma avaliação de maturação esquelética é requerida para predizer a idade cronológica em certas circunstâncias nas quais a idade cronológica não é documentada ou impossível de ser provada. Conduzir tais exames médicos sempre irá suscitar uma preocupação ética, especialmente em casos para avaliar maturidade sexual bem como exames envolvendo radiação ionizante. As barreiras culturais e religiosas também são discutidas no que diz respeito a padrões éticos estabelecidos na Arábia Saudita. Diversos aspectos éticos concernentes a exames de estimativa de idade incluindo aspectos relacionados a formulários de consentimento, privacidade e risco de radiação foram documentados. Ao passo que aspectos éticos que dizem respeito a risco de radiação serem mais provavelmente superáveis pela introdução de outras modalidades de exames de imagem sem risco de radiação, a ética relacionada a formulários de consentimento e privacidade ainda estão por serem melhorados.

Palavras chave: maturação esquelética, estimativa de idade, princípios éticos, risco de radiação

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Introduction

The estimation of age is becoming important from the forensic prospect including those who have an undocumented date of birth. Despite many efforts internationally in birth registration around the world, still, a quarter of the children around the world have no birth documentation*(1)*. In a recent report, more than 166 million children aged under 5 are unregistered*(2)*. The majority of these numbers come from countries in sub-Saharan Africa in which only 3%, 11%, and 12% of the births are registered in Ethiopia, Zambia, and Chad respectively. Many of those born in these countries migrate to Saudi Arabia to work unofficially, making the kingdom a key source of foreign remittances*(3)*.

Migrants who have no official documentation are estimated to be around 4 million migrants in Saudi Arabia*(3)*. Nevertheless, many factors build on Saudi Arabia as s special case when it comes to migration. Firstly, many refugees are hosted within the borders of Saudi Arabia such as in the case of the war in Yemen. Secondly, workers voluntarily migrate to work in a variety of sectors, in which the kingdom requires labor*(4)*. The presence of holy cities Makkah and Madinah, where around 10 million pilgrims travel for Hajj and Umrah every year, in which part of those pilgrims may not depart the kingdom afterward.

In Saudi law, a child is a person under 18 years old in which is entitled to support that is not available to adults such as health and educational support*(5)*. Moreover, a child under Saudi law is protected against all forms of abuse and neglect, and manifestations to which the child may be exposed in the surrounding environment. Nevertheless, the legal responsibilities upon a child have been set at various age milestones. For instance, criminal responsibility starts at the age of 7 years and a child with criminal activity can be detained in rehabilitation centers or social services centers for up to one year*(6)*.

Having said all of that, the estimation of a person's age has not been fully documented in Saudi Arabia. Age estimation is usually undertaken for those migrants with no proof of chronological age however, undocumented birth in remote are of Saudi Arabia*(7)*. Nevertheless, the lack of a birth certificate is an issue when it comes to children reaching school age, marriage, or involvement with law enforcement.

Globally, different approaches have been taken to estimate a person's chronological age including psychological assessment incorporating social interview, anthropometric measures and physical examination that inspect the signs of sexual maturation, dental examination with X-ray examination of the dentition, and X-ray of the left hand*(8-11)*. In cases where the skeletal development of the hand is incomplete, an additional examination of the clavicles should be carried out, preferably using a conventional X-ray examination and/or a computed tomography scan*(12,13)*. Carrying such medical examinations will always pose an ethical concern from different prospects*(14)*. Not only from a medical point of view but also from the cultural and religious barriers.

Material and Methods

This paper aims to analyze the ethical issues concerning age estimation examinations from different prospects including issues related to medical examination and radiation hazards involved within x-ray examinations. Nevertheless, issues regarding privacy when it comes to inspecting the signs of sexual maturation will also be discussed in light of Saudi cultural and religious beliefs. The consents forms involved within these medical examinations will also be discussed in the light of current legislation within Saudi Arabia. The current literature relevant to age estimation examinations will be analyzed, and the Saudi legislation will be discussed concerning the ethical recommendation and the scientific guidelines.

Discussion on the ethical issues related to:

Privacy:

Saudi law is based on Sharia law (Islamic law) which respects and granted privacy in several circumstances. It covers all aspects of privacy, from reading someone's letter without permission to private and family affairs*(15)*. Ethical guidelines in medical practices in Saudi stated that "The

principle in the religious ruling is the prohibition of exposure or examining of a person's private parts (Awra) unless there is a necessity; in that event, it becomes permissible to expose only what is needed (to be exposed) to diagnose the patient (male or female)"*(16)*. During the physical examination to determine the age, an inspection of the genitalia area is to be examined to ascertain sexual maturity*(17)*. However, in Islam, some scholars considered the whole body of women to be private parts*(18)*. In such cases, it is doubtful that an examination of the knee, not only the genitalia area, can be authorized. However, recently regulation by the Ministry of Health has been published to ensure privacy in terms of medical investigations*(16)*. These include limiting the time exposure and limiting the of healthcare professionals to those who are only required. The guidelines also insisted on the lack of alternative procedures to be able to carry out such an investigation that could involve examining private parts. Hence, the use of such an examination to assess sexual maturity in Saudi Arabia for forensic purpose are more likely to be discarded.

Consent form:

One of the important ethical requirements related to medical intervention is that the patient should give his/her consent to proceed with the intervention. The consent is usually determined to be valid once at least one of the following three criteria has been achieved*(19)*:

- Understanding information related to the examination and its effect
- The capability of the person to give a valid consent
- The consent should be voluntary

Within the practice of age estimation for forensic purposes, the correct application of these criteria has been questioned. The language barrier for those who are referred for age estimation is one of the most challenging criteria to apply*(20,21)*. Additionally, the difficulties to understand the medical language involved with these examinations may question the fulfillment of the first criterion. In Saudi Arabia, the majority of those illegal immigrants are from countries in which the Arabic language is not their official language*(3)*.

The capability of the person to give valid consent should be envaulted based on the age, maturity of the involved person as well the ability to understate the legal consequences of such an action. This has also been questioned given that the case is to determine a person is 18 years old or not*(22)*. Within the Saudi health regulation, "a written or an oral approval must be taken from the guardian or representative of the children who are under 15 years old, while who are 15-18 years old, a written or oral approval must be taken from the patient and his guardian"*(23)*. Therefore, medical examinations are not be undertaken for those who are under 18 years unless their parents give their permission. However, in the current Saudi legislation, the medical examination and therapeutic intervention become compulsory, in which patients' consent forms are irrelevant, in some cases that are expected to achieve the physical and mental health interest of a patient. It could be argued that age estimation is more likely to achieve mental health interest to those referred for that particular examination. In other words, treating a child as an adult can lead to mental health issues where becomes unable to communicate their needs.

The voluntariness applied within the age estimation examinations has been criticized by many studies*(22,24-26)*. Those referred to examinations are more likely to be forced by way or another to give their consent, which they may have no chance to refuse as refusal may impact their application. However, under the current Saudi legislation, voluntariness cannot be achieved as children cannot give consent alone. Furthermore, the majority of those illegal immigrants have traveled with no legal guardian, in which consent cannot be given. However, voluntariness in its meaning is a broad term differently applied from one discipline to another. For instance, people have no choice but to consent to medical examination when it comes to applying for a driving license or obtaining a paid seek to leave. Therefore, applying the principle of voluntariness should be reviewed in the light that these medical examinations are a compulsory step to achieve their required outcomes.

Radiation:

The use of ionizing radiation in medical procedures has always been associated with the general risk of carcinogenesis, particularly if children are exposed to the radiation*(27,28)*. Several methods exist for age estimate determination that involves the use of radiation. the assessment of age can be determined from left-hand radiograph, dental radiograph, and the use of computed tomography to assess the clavicle in some cases to confirm the age determine from left-hand radiograph*(8,9,13,29)*.

Although the radiation dose from the left-hand radiograph is relatively small, the use of a higher radiation-inducing modality has been a source of concern*(30)*. The benefit of exposing children to radiation should outweigh the associated risks. Even though a small effective radiation dose is usually associated with left-hand radiographs, other modalities have been introduced which have a lower radiation-associated risk. Studies have reported that using Dual Energy Absorptiometry X-ray (DXA), is likely to produce the same results as radiographs with the advantage of less exposure to ionizing radiation*(31,32)*.

The effective radiation dose from left-hand radiographs has been reported to be between (40 – 100 μSv), which is equivalent to a few days of natural background exposure*(27)*. However, when a DXA scan is used to determine bone age, the effective radiation dose is about 0.1 μSv which is equivalent to less than one hour of radiation from the natural background*(28)*. In other words, children are exposed to a significantly higher dose of radiation from the natural environment than from DXA in this study. Nevertheless, the use of computed tomography (CT) to assess the clavicle has been recommended in cases where the hand x-ray cannot estimate the chronological age. However, the use of such modality has a greater risk as the effective dose is 100 times greater (1.1 to 6.6 mSv) than the effective dose from left-hand x-ray*(33)*. Therefore, such a use of a modality that has higher risk should be limited to a case where a precise indication and accurate age limit are needed.

The disadvantage when using ionizing radiation is the radiation dose especially with CT scans as well as the artifacts that can cause the exam to be repeated. To overcome these disadvantages, research has been conducted to see whether other modalities that do not use ionizing radiation can be used. In particular, magnetic resonance imaging has been the focus of the research*(34,35)*. These studies revealed that MRI can be used in the field of age estimation with the advantage of protecting children from ionizing radiation.

Several techniques to determine the age based on radiographs from hand, dental and clavicle have been developed. These techniques are generally based on the assumption that the ossification centers of the bones appear and mature at different stages of life and in a consistent manner. Each stage is a reflection of the chronological age; hence, this method usually reflects the level of individual growth development*(9)*. There are several ethical considerations associated with the use of these radiographic methods in the assessment of age. Firstly, The reference standards used in these methods are originated from western, in which the applicability of this standard in populations from different ethnic backgrounds is questionable*(36-41)*. These studies argued that the left-hand radiograph standard does not apply to populations from Asian and African countries. In such cases the difference between the standards and the mean age of the group was up to 1.6 years, not to mention that Individual cases showed a bigger difference up to 4 years*(39,42,43)*. Other studies showed that standards used for the assessment of age from dental radiographs are not accurate when applied to Asians*(44-46)*. Even though, populations who are originated from the same ethnic background showed an advancement in terms of age compared to the original standard*(47,48)*. This has been related to the change in lifestyle as well as the secular trend in children's growth.

Conclusions

The estimation of a person's age needs further research investigations to be fully documented in Saudi Arabia. Several ethical issues concerning age estimation examinations including issues related to consent forms, privacy, and radiation hazards have been raised. While ethical issues regarding

radiation hazards are more likely to be overcome by introducing other imaging modalities without radiation hazards, ethics related to consent forms and privacy are still to be improved.

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