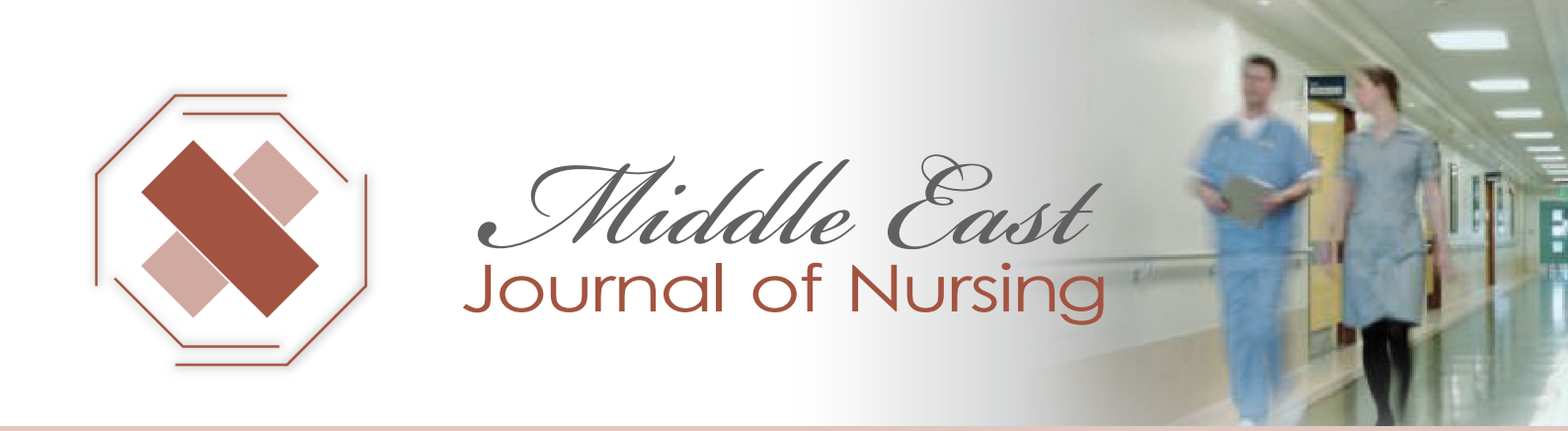

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Editorial

Original Contribution/Clinical Investigation

Review article

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In this issue a number of papers with authors from the region, Australia, Turkey and Lebanon are included.

Alanazi, T.N.M et al., aimed to translate the Ragins' Relational Mentoring Index (RMI) into Saudi Arabic language and to evaluate the psychometric properties, validity and reliability of the RMI – Saudi Arabic version (RMI-S). The authors stressed that mentorship is important in creating a positive learning environment conducive in transitioning from newly graduated nurse roles to professional nurse roles in Saudi Arabia. To have a valid and reliable instrument to measure Saudi nursing interns' perceptions of mentoring relationships during their clinical internship program, the RMI was translated to Saudi Arabic language. The authors used a descriptive design. A convenience sample of 279 nursing interns were recruited to participate in the study from three tertiary training hospitals in Riyadh, Saudi Arabia. The RMI was translated into Saudi Arabic language, validated, factor analyzed, and tested for reliability. The findings confirmed the content validity index of the RMI-S with the Scale-level Index and Item-level Index of 1. The factor analysis yielded three subscales, namely, inspiration and affirmation with α=.95, trust and commitment with α =.94, reliance on communal norms with α =.94, and overall with α =.97. The authors concluded that the RMI-S is a valid and reliable instrument that can be utilized as appropriate tool to evaluate high-quality mentoring relationships which can be used by Arabic speaking researchers and participants. They stressed that during clinical internship training, high-quality mentoring may be a relational source that safeguards mentees from challenges during transition from graduate nurse roles to professional nurse roles, and a valid and reliable instrument can help to evaluate it.

Alqarni, M.S., reviewed catheter associated urinary tract infection in ICU patient. He stressed that Catheter-associated urinary tract infection (CAUTI) is one of the most common hospital-acquired infections (HAI) in Australia, with nearly 200,000 reported incidents every year. According to Gardner, Mitchell, Beckingham, and Fasugba (2014), 15%–25% of patients admitted to a hospital are catheterised. A report from the World Health Organization (WHO) in 2018 showed that patients who were catheterised had a 5% greater chance of acquiring a urinary tract infection (UTI) for every day they are catheterised. In one month, the chances of acquiring the infection increase to 100%. Indwelling urinary catheters (IUCs) are regularly used in different wards or units in various hospital settings worldwide, but researchers have shown that the use of IUCs is more widespread in intensive care units (ICUs). He concluded that Catheter placement is a multidisciplinary decision and not the sole responsibility of nurses. Although the placement of an IUC is inevitable in many cases in ICU patients, it is entirely feasible to decrease CAUTIs through collaborative interventions. The best guideline that the healthcareprofessional can use in the prevention of CAUTIs is to limit the use of a urinary catheter and use only where there is a clear indication for use. Also, getting the catheter removed as soon as it is not required is just as necessary. Following the hospital guidelines and practising a proactive attitude and evidenced-based care promise a positive health outcome for any patient. Finally, utilising a quality improvement tool like PDSA will impact on the sustainability of theimprovement plan. Nonetheless, the limitation of this project is unable to evaluate potentialconfounding risk factors for CAUTI, including antibiotic exposure, because our data were primarily collected for surveillance purposes. Also, a small sample size and a pre-and-after design, susceptible to unmeasured confounding variables.

Dr Elghblawi, E., looked at hormone blockage and gender reassignment. She wonder what world are we living in and how can we play with our own biological and genetic make ups How can a child decide to block his/ her hormones, to assign the gender they wants to be, when they are still young, immature and probably still cannot decide or be certain, of their future ahead? She added that it was an unlawful action that left her demoralised, with low moods and suicidal ideations. She affirmed that the conducting doctor had rushed her and did not carry out a proper investigation to assess if her mental health was deranged or sound at the time, when she was diagnosed with gender dysphoria and wanted a gender reassignment. She stressed that, your body is your property and it should not be handled or messed up or extremely mutilated in such a way. It is your identity, your path and should be respected and reserved carefully unless it is a pathological issue not under your control and incurred like in certain well-known diseases. Most who have had this lengthy journey have apparently regretted and considered it a confused act in their darkest moment.

Helvaci M.R., et al., discussed two issue in two papers related to body mass index. In the first paper the authors tried to understand possible effects of sickle cell diseases (SCD) on metabolic parameters including systolic and diastolic blood pressure (BP) in the body. They studied 363 patients with the SCD (194 males) and 255 control cases (136 males), totally. They concluded that BMI may be the major determining factor of systolic and diastolic BP in human body. In the second paper understand possible effects of sickle cell diseases (SCD) on metabolic parameters including cholesterol values in the plasma. They studied 363 patients with the SCD (194 males) and 255 control cases (136 males), totally. significantly. They concluded that the BMI may be the major determining factor of TC, LDL, and HDL values in the plasma.

CROSS-CULTURAL ADAPTATION AND PSYCHOMETRIC EVALUATION OF THE RELATIONAL MENTORING INDEX – ARABIC VERSION IN SAUDI NURSING INTERNS

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Abstract

Aims: This study aimed to translate the Ragins' Relational Mentoring Index (RMI) into Arabic language and to evaluate the psychometric properties, validity and reliability of the RMI – Saudi Arabic version (RMI-S).

Background: Mentorship is important in creating a positive learning environment conducive in transitioning from newly graduated nurse roles to professional nurse roles in Saudi Arabia. To have a valid and reliable instrument to measure Saudi nursing interns' perceptions of mentoring relationships during their clinical internship program, the RMI was translated to Arabic language.

Methods: This study employed a descriptive design. A convenience sample of 279 nursing interns were recruited to participate in the study from three tertiary training hospitals in Riyadh, Saudi Arabia. The RMI was translated into Arabic language, validated, factor analyzed, and tested for reliability.

Results: The findings confirmed the content validity index of the RMI-S with the Scale-level Index and Item-level Index of 1. The factor analysis yielded three subscales, namely, inspiration and affirmation with α=.95, trust and commitment with α =.94, reliance on communal norms with α =.94, and overall with α =.97.

Conclusions: The RMI-S is a valid and reliable instrument that can be utilized as appropriate tool to evaluate high-quality mentoring relationships which can be used by Arabic speaking researchers and participants.

Relevance to clinical practice: During clinical internship training, high-quality mentoring may be a relational source that safeguards mentees from challenges during transition from graduate nurse roles to professional nurse roles, and a valid and reliable instrument can help to evaluate it.

Key words: Relational Mentoring Index, mentoring relationship, internship training, nurse intern, psychometric property, Saudi Arabia

Introduction

A global public health crisis attributed to a nursing shortage has been reported [1, 2]. According to WHO [3], 81-92% of the member states including USA, UK, Australia, New Zealand, other countries, and the Eastern Mediterranean Region particularly Saudi Arabia, have reported substantial nursing shortages. In Saudi Arabia there are 40 nurses for every 10,000 people and this shortage has been attributed to sociocultural factors, work environment and education factors [4].

There are strategies necessary to address the shortage and ensure sufficient nursing workforce. Aside from the Saudization program implemented in 1992, the one year clinical internship program was introduced in the Bachelor of Science in Nursing curriculum [5]. It was in accordance with the National Qualifications Framework for Higher Education published in 1430 H (2009), and in conjunction with the Classification of Qualifications in the Field of Nursing, Article 6 of the Guideline of Professional Classification and Registration for Health Practitioners [5]. Before awarding the Bachelor degree, Saudi nursing students need to complete the internship program designed to extensively train them with the necessary clinical skills to prepare them as newly graduated professional nurses

During the past ten years, creating a positive working environment by integrating mentoring has been advocated by several authors to encourage recruitment, retention of nurses, and reduction of the nursing shortage [6, 7]. However, during the internship training, nursing students face great challenges in transitioning from student to professional nurse. The training makes them feel vulnerable, and stressed with inherent problems in the transition from an idealistic student nurse to a realistic professional nurse [8-11]. During the transitioning phase, the mentor plays a significant role in facilitating the development of nursing students in becoming professional nurses [12], and helps them achieve a successful transition through creating a high-quality relationship.

The literature apparently shows that there has been lack of clarity about understanding the qualities, characteristics, and outcomes of the average mentoring relationship. Until a decade ago, Ragins and Kram [13] examined the high-quality end of the continuum of the relationship where mentoring exemplifies a life-altering relationship that inspires and focuses on positive relationship at work for individuals, groups, and organizations [14, 15]. High-quality formal relationships can be more effective than low-quality informal relationships [15]. Those with mentors, whether in formal or informal mentoring relationships, generally have more positive work and career attitudes than those without mentors [15-17]. In this study, formal mentoring was instituted in the internship program where the training hospitals initiated efforts to match mentors and mentees.

In nursing, mentorship is established when mentors help students and novice nurses to acquire self-confidence, networking, career opportunities, socialization, skills and competencies [9]. In addition, building competence, professional foundations and confidence will guide the students to a successful transition from student to nurse role [18]. Ragins and Cotton [19] defined mentors as individuals with advanced knowledge and experience who are committed in providing mobility and support to their mentees.

Although much has been written on the mentoring relationship in nursing, there is an apparent scarcity of Arabic instruments that evaluate the nurse—nurse intern (mentor—mentee) relationships in the region. Ragins [15] suggested that a mentoring relationship instrument needs to be validated and assessed in its ability to predict outcomes of high-quality relationships. In order to enhance the understanding of the nature of mentoring relationship among mentors and Saudi nursing interns, there is a need to establish the validity and reliability of the Ragins' Relational Mentoring Index – Saudi Arabic version (RMI-S). This study therefore aimed to establish the validity and reliability of the RMI-S.

Method

Research design

This descriptive study utilized translation of the original English version of the RMI [15], into Arabic language. Validation, exploratory factor analysis, and reliability tests were performed. In lieu of creating a new scale for Saudi Arabia or other Arab countries, research literature recommended to use a version of an already tested measure in different cultures [20, 21]. However, this measure needs to be developed in accordance to a strict methodology to ensure the semantic and technical equivalence and the construct, content, and criterion validity. Thus, such instrument must be validated in the new cultural context [20-23].

Sample and settings

A panel of translators was comprised of five Saudi PhD degree holders in Nursing. Four of the five experts were tenured faculty of the College of Nursing at King Saud University and have been handling Saudi nursing students for at least five years both in the clinical and theoretical courses. The fifth expert was the director of nursing education in one of the training hospitals. Another panel of five bilingual Saudi PhD holders conducted the validation of the final Arabic version of the RMI using the Content Validity Index and Scale-level Validity Index. Thirty Saudi pre-interns (15 males and 15 females) were recruited for the pretest of the RMI-S. The pretest participants were asked to provide comments on items which seemed difficult to understand. After completing the survey, the respondents were instructed to seal the questionnaire inside the envelope before submitting to the researchers. Apparently, there were no major concerns that were raised by the pretest participants and they accomplished the 21-item questionnaire within 4-7 minutes.

A total of 279 Saudi nursing interns participated in the study. The response rate was 80% of the registered

interns for the Academic Year 2017-2018, and who were currently undergoing clinical training in three tertiary training hospitals in Riyadh, Saudi Arabia. The participants included Saudi nursing interns who were officially registered in the Academic Year 2017-2018, undertaking their training in the three training hospitals, available during the conduct of the study, and voluntarily and willingly participated. Excluded in the study were non-Saudis, nursing students undergoing their undergraduate clinical training in any of the three training hospitals, and those unavailable and unwilling to participate during data collection. Data were collected between December 2017 and February 2018.

Instrument

The questionnaire utilized to collect data from the Saudi nursing interns has two parts. The first part was comprised of demographic profile including, gender, age, months in internship program, internship hospital, and pre-internship nursing school. The second part comprised the RMI with 21-items [15], which assessed the characteristics, behaviors, and attributes found in high-quality mentoring relationships. The relational functions included six subcategories: personal learning and growth, inspiration, affirmation of selves, reliance on communal norms, shared influence and mutual respect, and relationship trust and commitment. The scale used a 7- point Likert Scale with 1 as strongly agree, 3 as neutral, and 7 as strongly disagree. According to Ragins [15], there was no discussion of validity for this scale. In addition, upcoming directions of the instrument included but were not limited to future research that needs to validate and assess its ability to predict high-quality relationship outcomes, and use of dyadic approach to assess its psychometric properties for both mentors and mentees, which led to the conduct of this study.

Data Analyses

Cross-cultural Adaptation of RMI

The cross-cultural adaptation of the RMI was based on the guidelines by Beaton et al. [24]. The production of the Saudi Arabic version followed five stepwise phases including (1) translation, (2) synthesis, (3) back translation, (4) experts' review, and (5) pretesting.

Translation of RMI from English to Arabic Version

The translation of RMI followed the repeated forward-backward translation technique [25]. The translation involved seven stages performed by bilingual participants from Saudi Arabia. The evaluators or translators included bilingual Saudi professors in the nursing college, and linguistic experts in English and Arabic translation.

There were 2 translators involved in Stage 1. The translators included Assistant Professors in the College of Nursing who obtained doctorate degree in an English-speaking country with experiences in English-Arabic translation. Both independently translated the English version of the RMI to Arabic. In Stage 2, a Saudi faculty member with PhD degree obtained in USA synthesized and consolidated the two Arabic versions into a single translated Arabic Version 1.

In stage 3, the Arabic Version 1 was presented to two bilingual doctorate degree holder faculty members in one of the nursing colleges in Saudi Arabia. Both used English and Arabic language in their education-related activities with Saudi students. The translators evaluated Arabic Version 1 and compared it with the original English version. Both focused on the coherence and meaning of the items and possible responses. The evaluators identified minor inconsistencies and they were modified which resulted in the production of Arabic Version 2.

In Stage 4, two bilingual female Saudi PhD tenured faculty members back-translated the Arabic Version 2 to English. These two translators were not involved in stages 1, 2 and 3.

In Stage 5, two linguistic experts compared the 2 back translated versions with the English version. Both determined the meaning and differences between the original and back-translated versions.

In stage 6, Arabic terms that caused discrepancy in meaning were replaced. The process from the identification of discrepancies up to changing the suitable Arabic terms were repeated until consensus agreement of the final Arabic version was obtained.

Stage 7 involved the pretesting of the final RMI-S. Pretest was done to 30 participants who were not included in the main study to ascertain ease in reading, understanding, and responding to the items. The participants in the pretest accomplished the questionnaire without major concerns.

Validity of RMI-S

Content validity was determined by computing the item-level content validity index (I-CVI) and scale-level content validity index (S-CVI). An I-CVI of 1 for a panel of five experts and S-CVI of .90 or higher was acceptable [26].

Reliability of RMI-S

Data processing and analyses for the exploratory factor analysis were completed using IBM SPSS for Windows version 21.0 (Armonk, NY; IBM Corp.). Before proceeding with the analysis, data screening was conducted. There were 279 surveys that were processed. The 1:10 ratio of variable to samples was made as the basis for sample size requirement. Since there were 21 variables in the Relational Mentoring Index, the minimum sample size should at least be 210. There were 279 surveys retrieved indicating that the sample size was more than adequate to conduct principal component analysis. Further examination of the P-P plots of each item showed linearity and the histograms showed apparently normal distribution. Multicollinearity and singularity were absent. Inspection of the correlation matrix indicated that most of the correlations were more than 0.30, thereby qualifying for further analysis.

Principal component analysis with Varimax rotation was performed to determine the factor loadings. The reliability of the RMI-S was determined using Cronbach's alpha for internal consistency and reliability. Cronbach's alpha of more than or equal to 0.70 was acceptable [27, 28]. The item-total correlation coefficients (ITCs) were determined to support the internal consistency of the scale and an ITC >.30 was considered acceptable [29].

Ethical considerations

Ethical approval from the Institutional Review Board of the College of Medicine at King Saud University was obtained before conducting the study. Permission was obtained from the administrators of the facilities to conduct the study on the Saudi Nursing interns. Participants were informed of the objectives of the study, confirmed their voluntary participation, assured confidentiality of identities and responses, and informed consent was obtained from each of them before they were included in the study. Voluntary participation was obtained when the participants filled out the questionnaires and sent them back to the researchers.

Results

Demographic profile

Among the 279 participants (Table 1), most of them were females (n=196; 70.3%); 23 years old and older (n=178; 63.8%); between 1-4 months in the internship program (n=146; 52.3%); having internship at Hospital 3 (n=148; 53.05%); and had their pre-internship program from public schools of nursing (n=258; 92.5%).

Validity of the RMI-S

The item-level and scale-level content validity for the instrument were calculated. The computed I-CVIs were 1, as shown in Table 2. The panel of experts reached a consensus on the final RMI-S with the computed S-CVI/Ave of 1, as shown in Table 3.

Exploratory Factor Analysis of the RMI-S

A principal component analysis was conducted on the Saudi Arabic version of the 21-item scale using Varimax rotation method with Kaiser Normalization. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded .925 which is considered superb [30]. The KMO values for the individual items ranged between .615 and .870 which were all above the acceptable limit of .5 [30]. Bartlett's Test of Sphericity X^2 (210) = 7674.42, p<0.001, showed that the correlations between items were sufficiently large for principal component analysis. Analysis was run to obtain Eigenvalues for the components in the data. Three components had Eigenvalues more than Kaiser's criterion of 1 that combined in explaining 79.95% of the variances. Table 4 shows the factor loadings after rotation. In component 1, nine items were clustered and represented inspiration and affirmation with factor loadings ranging between 0.545 and 0.872; component 2 represented trust and commitment with eight items and factor loadings ranging between 0.633 and 0.762; and component 3 represented reliance on communal norms with four items and factor loadings ranging between 0.742 and 0.848.

Reliability of the RMI-S

Reliability analysis was done using Cronbach's α Inspiration and affirmation with α = .95, trust and commitment with α = .94, and reliance on communal norms with α = .94, had high reliabilities. Examination of the corrected item-total correlations yielded values between .703 and .892 suggesting that each of the items correlated very well with the corresponding subscale and with overall scale. Examination of the αs if item is deleted yielded values that did not significantly add to the reliability of the subscales. When taken on a whole, The Relational Mentoring Index Saudi version (RMI-S) had an overall Cronbach's α = .97 suggesting that RMI-S has very good reliability (Table 4).

Discussion

The validity and reliability of instrument to measure high-quality mentoring relationships between mentors and Saudi nursing interns is important in the clinical internship program in Saudi Arabia. Thus, the RMI was translated into Arabic language. This study endeavored to translate the RMI and assessed the psychometric properties of RMI-S in Saudi nursing interns. Results of this study presented evidence that strongly supports the sound content validity and reliability, which are significant indicators of quality measurement. The use of a valid and reliable tool is critical for ensuring accurate measurement of the constructs being studied and facilitates the reduction of errors in the measurement process. The reliability of the instrument was established by assessing the internal consistency of the measurement. Validity, on the other hand, ensured that the instrument measures what was intended to be measured [31, 32]. The outcomes showed an acceptable item-level and scale-level content validity as evaluated by the panel of five experts. Assessing the content validity of the scale is important in establishing its quality. It has also been recommended that the content validation of scale should be clearly reported in scale development studies; hence, both item-level and scale-level content validity should be reported [26].

In this study, all 21 items of RMI-S were rated 3 (quite relevant) and 4 (highly relevant) by the five experts. This yielded an I-CVI of 1 for all of the items, which met the standard criteria set for an acceptable I-CVI [33]. For the scale-level validity, the study utilized validity using the S-CVI/Ave method as recommended by Polit & Beck [26], who have stated that universal agreement is very difficult to achieve if there are many members of the panel with varying viewpoints. Thus, to conclude that a scale had excellent content validity, it should have an I-CVI of 1 for 3 to 5 panel members and a minimum of 0.78 for 6—10 members. In addition, the scale should have an S-CVI/Ave of 0.90 or higher [26, 33]. These criteria were met in this study and thus supported the acceptable content validity of RMI-S.

Table 1. Characteristics of Participants (N=279)

Characteristics	f	%
Gender		
Male	83	29.7
Female	196	70.3
Age group		
22 years old and below	101	36.2
23 years old and older	178	63.8
Mean =22.78		
SD =1.19		
Months in internship program		
1-4 months	146	52.3
5-8 months	77	27.6
9-12 months	56	20.1
Internship setting		
Hospital 1	32	11.47
Hospital 2	99	35.48
Hospital 3	148	53.05
Pre-internship nursing school		
Public	258	92.5
Private	21	7.5

Table 2. I-CVI of the Relational Mentoring Index (RMI) Saudi Arabic Version (21-Item Scale) by Five Experts: Items Rated 3 or 4 on a 4-Point Relevance Scale

Item No.	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Total Number or Relevant Items	Item-level Index
1	4	3	4	4	3		5
2	4	4	4	4	4		5
3	4	4	4	4	4		5
4	4	4	4	4	4		5
5	4	4	3	4	4		5
6	4	4	4	4	4		5
7	4	4	4	4	4		5
8	4	3	4	4	3		5
9	4	3	4	4	3		5
10	4	4	3	4	4		5
11	4	4	4	4	4		5
12	4	4	4	4	4		5
13	4	4	4	4	4		5
14	4	4	4	4	4		5
15	4	4	4	4	4		5
16	4	4	4	4	4		5
17	4	4	4	4	4		5
18	4	4	4	4	4		5
19	4	4	4	4	4		5
20	4	4	4	4	4		5
21	4	4	4	4	4		5

Note: The I-CVI should be 1.00 if there are 5 or fewer experts (Lynn, 1986)

Table 3. S-CVI Ratings of the RMI Saudi Arabic Version by Five Experts: Items Rated 3 or 4 on a 4-Point Relevance

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Total and Mean I-CVI
Total	21	21	21	21	21	21.00
Proportion Relevant	1.00	1.00	1.00	1.00	1.00	1.00
Mean Expert PR	1.00					

Note: Since the S-CVI is > 0.90 therefore the overall scale is valid (Polit & Beck, 2006).

Table 4. Summary of exploratory factor analysis results for the Arabic Translation of Relational Mentoring Index (Adapted from Ragins, 2012) (N=279)

Items	Rotated Factor Loadings			CITC‡; α if item deleted
	1†	2††	3†††	
4. My partner has inspired or been a source of inspiration for me. لقد قام شريكي بالهامي او كان مصدر الهاما لي	.872			.831; .95
6. I am often inspired by my partner. في الغالب شريكي هو من يمنحني الالهام	.866			.831; .95
2. My partner helps me learn about my personal strengths and weaknesses. يساعدني شريكي على أن اتعرف على مواطن الضعف والقوة الشخصية لدي	.801			.886; .95
3. My partner helps me learn more about myself. يساعدني شريكي في أن اعرف الكثير عن نفسي	.799			.838; .95
7. My partner is helping me become the person I aspire to be. يساعدني شريكي أن أكون الشخص الذي اطمح اليه	.749			.877; .95
5. My partner gives me a fresh perspective that helps me think "outside the box." يمنحني شريكي نظرة واقعية تساعدني على " التفكير خارج الصندوق-التفكير غير الاعتاد عليه "	.740			.795; .95
1. My partner is helping me learn and grow as a person. يساعدني شريكي في أن اتعلم واكبر كشخص	.725			.852; .95
8. My partner sees me not only I am now, but also for who I aspire to be. يساعدني شريكي أن أكون الشخص الذي اطمح اليه	.697			.805; .95
12. I can be myself with my partner. يمكنني ان أكون على حريتي وطبيعتي مع شريكي	.545			.746; .95
19. Our relationship is founded on mutual trust and commitment. علاقتنا مبنية على الثقة والالتزام المتبادل		.762		.892; .92
20. My partner and I trust each other, and we are committed to the relationship. نحن نثق في بعضنا البعض وملتزمون بعلاقتنا		.741		.857; .93
9. My partner always sees the best in time. دائما ما يرى شريكي ما هو افضل لدي		.685		.759; .93
17. We respect each other, and we value what each person has to say. نحن نحترم بعضنا ونقدر ما يقوله كل منا بلحترام		.685		.811; .93
10. My partner seems to bring out the best in me. يساعدني شريكي في أن أخرج أفضل ما لدي		.665		.784; .93
11. My partner accepts me for who I am. يتقبلني شريكي كما انا		.649		.785; .93
21. Trust and commitment are central to our relationship. الثقة والالتزام هما اساس علاقتنا		.633		.703; .94
18. There is mutual respect and influence in our relationship. يوجد بيننا احترام متبادل وتأثير متبادل في علاقتنا		.633		.815; .93
15. We give each other without expecting repayment. نحن نساعد بعضنا في علاقتنا بدون توقع مقابل			.848	.875; .92
16. My partner and I respect and influence each other. أنا و شريكي نحترم بعضنا ونؤثر ايجابيا في بعض			.809	.842; .93
13. In our relationship, we help each other without expecting repayment. نحن نساعد بعضنا في علاقتنا بدون توقع مقابل			.809	.885; .92
14. We never keep score of who gives and who gets in our relationship. نحن لا نتعامل أبدا بمبدأ المقارنة بمن يعطي ومن يأخذ			.742	.858; .92
Eigenvalues	13.37	2.21	1.20	
% of Variance	63.69	10.53	5.73	
Cronbach's Alpha (α) (overall = .971)	.958	.943	.944	

Regarding reliability, desirable internal consistency was observed – it is described as the ability to find correlation (homogeneity) between the items of a scale-fashioned instrument; that is, to find whether they measure the same theoretical construct they are proposed to. The findings also supported the excellent reliability of the scale. The computed overall Cronbach's alpha value (α=0.971) was greater than the accepted value of 0.70. This suggested an excellent internal consistency of the scale. The achievement of internal consistency of a scale implies that the items in the scale are interrelated [34]. The measure of internal consistency obtained by Cronbach's alpha is important and desirable when working with an instrument aiming to measure a single construct through multiple items. The most commonly used measure of internal consistency is the computation of Cronbach's alpha. A higher value of the Cronbach's alpha indicates a higher level of reliability, thus it represents a higher precision of measurement by the tool [31, 32].

Five validators were consulted on the results of the factor loadings for their expert opinion regarding the realignment of factor loadings of the subscales of the instrument. The panel reached the consensus of endorsing three component factors from six of the original RMI to be used in the final Arabic version. The current study pursued modification of the factor structures using an EFA due to language distinctions. The results of this study exposed new directions for future research because of the use of EFA to modify the factor structures. The results indicated differences in many aspects between the Arabic and English versions. The adaption of all items of the English version in the Arabic version experienced major challenge which led to modification of subscale structures. However, all items were retained in the Arabic version of the factor structures which means that the scale yielded the finest fit when it consisted of all items (collective) rather than by each subcategory. The factor analysis showed three groups of items as follows. Factor 1 – inspiration and affirmation includes items 1-8 and 12 which reflect the capacity to inspire leading to positive outcomes for the individual and work relationships. Factor 2 – trust and commitment includes items 9-11 and 17-21which reflect perceiving partners as being committed to the relationship and that they give on the basis of need rather than self-interest. Lastly, factor 3 – reliance on communal norms includes items 13-16 which reflect relationships focused on partner's well-being and benefits without expecting repayment.

The findings of this study are similar to another psychometric assessment study as a result of cultural and health system differences [35]. In addition, this contributes to the existing literature on Saudi Arabian nursing culture and is vital for understanding the nature of the mentoring relationship observed among mentors and Saudi nursing interns. The Saudi Arabian culture is considered to be a collectivist society in contrast to American individualist society. In this study, Saudi nursing interns identified themselves as being part of a group; family as the center of their culture [36], where results reflected strong (mentor-mentee group) mentor relations in high-quality relationships specifically on inspiration and affirmation, trust and commitment, and reliance on communal norms. The findings of this study on the modified factor structures are similar to a qualitative work by Jackson et al. [10] that personal and relational characteristics such as mutual respect and trust, and fostering passion and creating inspiration comprise effective mentorship between mentor-mentee dyad. Furthermore, relational-cultural approach to mentoring emphasizes collective and collaborative success which postulated that mentor-mentee relationship and the organization may undergo positive transformation [37].

The institution of the psychometric properties of RMI-S has significant implications for nursing education and practice. The scale had sound reliability, which was calculated through internal consistency, and was found to perform well in the tests for I-CVI and S-CVI. Furthermore, it reported promising results. However, further studies are required with a higher number of participants who are more heterogeneous and less contained samples. Investigations with samples of nursing interns undergoing internship in different hospitals (private and public) from other regions in the kingdom are recommended to evaluate regional differences or similarities. The regionalism and the large territorial extension of the Kingdom of Saudi Arabia, as well as the social, economic, religious and cultural characteristics that are peculiar to health care institutions must be considered. Although the methods employed in the study to establish validity of the RMI-S were adequate, other methods, like confirmatory factor analysis, convergent and divergent validity tests, and concurrent validity tests should also be attempted to strengthen the current findings. Having presented such limitations, the findings of this study confirmed the RMI-S can be adapted and can be used for evaluating high-quality mentoring relationships in Saudi nursing interns in Saudi Arabia and other Arabic-speaking countries .

Conclusion

The study reported the results of the cross-cultural adaptation, validity and reliability of the RMI-S. Based on the content validity confirmed by the experts of the translation into Arabic, the excellent construct validity, and excellent results of the psychometric analysis, and reliability test, we concluded that the RMI-S is valid and reliable to assess high-quality mentoring relationships of Saudi nursing interns with their mentors in the clinical internship program in Saudi Arabia.

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BODY MASS INDEX MAY BE THE MAJOR DETERMINING FACTOR OF SYSTOLIC AND DIASTOLIC BLOOD PRESSURE IN THE HUMAN BODY

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Abstract

Background: We tried to understand possible effects of sickle cell diseases (SCD) on metabolic parameters including systolic and diastolic blood pressure (BP) in the body.

Methods: All patients with the SCD and age and gender-matched control cases were included into the study.

Results: We studied 363 patients with the SCD (194 males) and 255 control cases (136 males), totally. Mean ages of the SCD patients were similar in males and females (31.1 versus 31.0 years, respectively, p>0.05). Although the mean body weight and body mass index (BMI) were significantly suppressed in the SCD patients (59.9 versus 71.5 kg and 21.9 versus 25.6 kg/m2, respectively, p= 0.000 for both), the mean body heights were similar in both groups (164.9 versus 167.0 cm, p>0.05). Parallel to the suppressed mean body weight and BMI, fasting plasma glucose (92.8 versus 97.6 mg/dL, p= 0.005), total cholesterol (121.4 versus 165.0 mg/dL, p= 0.000), low density lipoproteins (70.4 versus 102.4 mg/dL, p= 0.000), and high density lipoproteins (26.0 versus 39.6 mg/dL, p= 0.000) were all lower in the SCD patients, significantly. Similarly, both systolic (115.2 versus 122.6 mmHg, p= 0.000) and diastolic BP (73.0 versus 86.6 mmHg, p= 0.000) were also lower in them, significantly. Interestingly, only the mean triglycerides value was higher in the SCD patients (129.4 versus 117.3 mg/dL, p= 0.000), significantly. Similarly, mean alanine aminotransferase value was not suppressed in them, too (27.4 versus 27.3 U/L, p>0.05).

Conclusion: BMI may be the major determining factor of systolic and diastolic BP in the human body.

Key words: Body mass index, systolic blood pressure, diastolic blood pressure, metabolic syndrome, sickle cell diseases

Introduction

Chronic endothelial damage may be the major underlying cause of aging and death by causing end-organ insufficiencies in the human body (1, 2). Much higher blood pressure (BP) of the afferent vasculature may be the major underlying factor by causing recurrent injuries on vascular endothelium. Probably, whole afferent vasculature including capillaries are mainly involved in the process. Therefore the term venosclerosis is not as famous as atherosclerosis in the literature. Due to the chronic endothelial damage, inflammation, edema, and fibrosis, vascular walls thicken, their lumens narrow, and they lose their elastic nature, and this eventually reduces blood supply to the terminal organs, and increases systolic BP further. Some of the well-known triggering causes or signs of the inflammatory process are physical inactivity, sedentary lifestyle, animal-rich diet, smoking, alcohol, overweight, hypertriglyceridemia, dyslipidemia, impaired fasting glucose, impaired glucose tolerance, white coat hypertension, chronic inflammations, prolonged infections, and cancers for the development of terminal consequences including obesity, hypertension (HT), diabetes mellitus (DM), cirrhosis, chronic obstructive pulmonary disease (COPD), coronary heart disease (CHD), chronic renal disease (CRD), peripheric artery disease (PAD), mesenteric ischemia, osteoporosis, stroke, dementia, various end-organ insufficiencies, aging, and death (3, 4). Although early withdrawal of the triggering causes can delay terminal consequences, after development of HT, DM, cirrhosis, COPD, CRD, CHD, PAD, mesenteric ischemia, osteoporosis, stroke, dementia, various end-organ insufficiencies, and aging, endothelial changes cannot be reversed completely due to their fibrotic nature. The triggering causes and terminal consequences are researched under the titles of metabolic syndrome, aging syndrome, or accelerated endothelial damage syndrome in the literature, extensively (5, 6). On the other hand, sickle cell diseases (SCD) are chronic inflammatory processes on vascular endothelium terminating with accelerated atherosclerosis induced end-organ failures and shortened survival in both genders (7, 8). Hemoglobin S (Hb S) causes loss of elastic and biconcave disc shaped structures of red blood cells (RBC). Probably loss of elasticity instead of shape is the main problem because sickling is rare in peripheric blood samples of patients with associated thalassemia minors, and human survival is not affected in hereditary spherocytosis or elliptocytosis. Loss of elasticity is present during whole lifespan, but exaggerated with inflammations, infections, and various stresses of the body. The hard RBC induced chronic endothelial damage, inflammation, edema, and fibrosis terminate with disseminated tissue hypoxia all over the body (9, 10). As a difference from other causes of chronic endothelial damage, the SCD may keep vascular endothelium particularly at the capillary level (11), since the capillary system is the main distributor of the hard cells into the tissues. The hard RBC induced chronic endothelial damage builds up an advanced atherosclerosis in much younger ages of the patients. Vascular narrowings and occlusions induced tissue ischemia and infarctions are the final consequences of the SCD, so the mean life expectancy is decreased by 25 to 30 years in the SCD patients (12). Actually, the SCD and metabolic syndrome may have similar pathophysiologic effects on the human body, and SCD are a chance for us to see several consequences of metabolic syndrome on the human body in much earlier ages of the patients. We tried to understand possible effects of the SCD on metabolic parameters including systolic and diastolic BP in the present study.

Material and methods

The study was performed in the Medical Faculty of the Mustafa Kemal University on all patients with the SCD and age and gender-matched control cases between March 2007 and June 2016. The SCD are diagnosed with the hemoglobin electrophoresis performed via high performance liquid chromatography. Medical histories of the SCD patients were learnt. A complete physical examination was performed by the Same Internist. Body mass index (BMI) of each case was calculated by the measurements of the Same Internist instead of by verbal expressions. Weight in kilogram is divided by height in meter squared (13). Systolic and diastolic BP were checked after a 5-minute rest in seated position by using the mercury sphygmomanometer (ERKA, Germany), and no smoking was permitted during the previous 2 hours. Cases with acute painful crisis or any other inflammatory event were treated at first, and the laboratory tests and clinical measurements were performed on the silent phase. A check up procedure including fasting plasma glucose (FPG), total cholesterol (TC), high density lipoproteins (HDL), triglycerides (TG), serum creatinine, alanine aminotransferase (ALT), markers of hepatitis viruses A, B, C and human immunodeficiency virus, a posterior-anterior chest x-ray film, and an electrocardiogram was performed. Eventually, the mean body weight, height, BMI, FPG, TC, low density lipoproteins (LDL), HDL, TG, ALT, and systolic and diastolic BP were detected in each group, and compared in between. Mann-Whitney U Test, Independent-Samples t Test, and comparison of proportions were used as the methods of statistical analyses.

Results

The study included 363 patients with the SCD (194 males) and 255 control cases (136 males), totally. The mean ages of the SCD patients were similar in males and females (31.1 versus 31.0 years, respectively, $p>0.05$). Although the mean body weight and BMI were significantly suppressed in the SCD patients (59.9 versus 71.5 kg and 21.9 versus 25.6 kg/m2, respectively, $p= 0.000$ for both), the mean body heights were similar in both groups (164.9 versus 167.0 cm, $p>0.05$). Parallel to the suppressed mean body weight and BMI, FPG (92.8 versus 97.6 mg/dL, $p= 0.005$), TC (121.4 versus 165.0 mg/dL, $p= 0.000$), LDL (70.4 versus 102.4 mg/dL, $p= 0.000$), and HDL (26.0 versus 39.6 mg/dL, $p= 0.000$) were all lower in the SCD patients, significantly. Similarly, both systolic (115.2 versus 122.6 mmHg, $p= 0.000$) and diastolic BP (73.0 versus 86.6 mmHg, $p= 0.000$) were also lower in them,

significantly. Interestingly, only the mean TG value was higher in the SCD patients (129.4 versus 117.3 mg/dL, p= 0.000), significantly. Similarly, mean ALT value was not suppressed in them, too (27.4 versus 27.3 U/L, p>0.05) (Table 1).

Discussion

Higher BP indicates that heart and blood vessels are being overworked. In most people with HT, increased peripheral vascular resistance accounts for HT while cardiac output remains normal (14). The increased peripheral vascular resistance is mainly attributable to structural narrowing of small arteries and arterioles, although a reduction in the number of capillaries may also contribute (15). HT is rarely accompanied by symptoms in the short-term. Symptoms attributed to HT in that period may actually be related to associated anxiety rather than HT itself. However, HT may be the major risk factor for CHD, CRD, cirrhosis, COPD, stroke, dementia, and PAD-like end-organ insufficiencies in the long-term. For example, a reduction of the BP by 5 mmHg can decrease the risk of stroke by 34% and CHD by 21%, and reduce the likelihood of dementia, heart failure, and mortality from cardiovascular diseases (16). On the other hand, we cannot detect any absolute cause in the majority of patients with HT. Physical inactivity, sedentary lifestyle, animal-rich diet, excess weight, smoking, alcohol, chronic inflammations, prolonged infections, and cancers may be found among the possible risk factors of HT. Particularly, excess weight may be the major underlying cause of HT in the world, now. Adipose tissue produces leptin, tumor necrosis factor-alpha, plasminogen activator inhibitor-1, and adiponectin-like cytokines, acting as acute phase reactants in the plasma (17). Excess weight-induced chronic low-grade vascular endothelial inflammation may play a significant role in the pathogenesis of accelerated atherosclerosis in the human body (18). Additionally, excess weight leads to myocardial hypertrophy terminating with a decreased cardiac compliance. A combination of these cardiovascular risk factors eventually terminate with increased risks of arrhythmias, cardiac failure, and sudden death. Similarly, the prevalence of CHD and stroke increased parallel to the increased BMI in other studies (19, 20), and risk of death from all causes including cancers increased throughout the range of moderate to severe weight excess in all age groups (21). The relationship between excess weight, elevated BP, and hypertriglyceridemia is described in the metabolic syndrome, and clinical manifestations of the syndrome include obesity, dyslipidemia, HT, insulin resistance, and proinflammatory and prothrombotic states (22). Similarly, prevalences of excess weight, DM, HT, and smoking were all higher in the hypertriglyceridemia group (200 mg/dL and higher) in another study (23). On the other hand, the greatest number of deteriorations in the metabolic parameters was observed just above the plasma TG value of 60 mg/dL in another study (24). Interestingly, plasma TG were the only lipids that were not suppressed parallel to the suppressed body weight and BMI in the SCD patients in the present study.

Cholesterol, TG, and phospholipids are the major lipids of the body. Cholesterol is an essential structural component of animal cell membrane, bile acids, adrenal and gonadal steroid hormones, and vitamin D. TG are fatty acid esters of glycerol, and they are the major lipids transported in the blood. The bulk of fat tissue deposited all over the body is in the form of TG. Phospholipids are TG that are covalently bound to a phosphate group. Phospholipids regulate membrane permeability, remove cholesterol from the body, provide signal transmission across the membranes, act as detergents, and help in solubilization of cholesterol. Cholesterol, TG, and phospholipids do not circulate freely in the plasma instead they are bound to proteins, and transported as lipoproteins. There are five major classes of lipoproteins including chylomicrons, very low density lipoproteins (VLDL), intermediate density lipoproteins (IDL), LDL, and HDL in the plasma. Chylomicrons carry exogenous TG from intestine to liver via the thoracic duct. VLDL are produced in the liver, and carry endogenous TG from the liver to the peripheral organs. In the capillaries of adipose and muscle tissues, 90% of TG is removed by a specific group of lipases. So VLDL are converted into IDL by removal of TG. Then IDL are degraded into LDL by removal of more TG. So VLDL are the main sources of LDL in the plasma. LDL deliver cholesterol from the liver to other parts of the body. Although the liver removes the majority of LDL from the circulation, a small amount is uptaken by scavenger receptors on macrophages that may migrate into arterial walls and become the foam cells of atherosclerotic plaques. HDL remove fats and cholesterol from cells, including within arterial wall atheroma, and carry the cholesterol back to the liver and steroidogenic organs including adrenals, ovaries, and testes for excretion, reutilization, and disposal. All of the carrier lipoproteins in the plasma are under dynamic control, and are readily affected by diet, illness, drug, body weight, and BMI. Thus lipid analysis should be performed during a steady state. But the metabolic syndrome alone is a low grade inflammatory process on vascular endothelium all over the body. Thus the metabolic syndrome alone may be a cause of the abnormal lipoprotein levels in the plasma. Similarly, due to the severe inflammatory nature of the SCD, plasma TC (121.4 versus 165.0 mg/dL, p<0.000) and LDL values (70.4 versus 102.4 mg/dL, p<0.000) were suppressed parallel to the suppressed mean body weight (59.9 versus 71.5 kg, p<0.000) and BMI (21.9 versus 25.6 kg/m2, p<0.000) in the present study. On the other hand, although HDL are commonly called 'the good cholesterol' due to their roles in removing excess cholesterol from the blood and protecting the arterial walls against atherosclerosis (25), recent studies did not show similar results. Instead, low plasma HDL values should alert clinicians about searching for additional metabolic or inflammatory pathologies in the human body (26, 27). Normally, HDL may show various anti-atherogenic properties including reverse cholesterol transport and anti-oxidative and anti-inflammatory properties (26). However, HDL may become 'dysfunctional' in pathologic conditions which means that relative compositions of lipids and proteins, as well as the enzymatic activities of HDL are altered (26). For example, properties of HDL are compromised in patients with DM due to the oxidative modification and glycation as well as the transformation of HDL proteomes into proinflammatory proteins. Additionally, the highly effective agents of increasing HDL levels such as niacin, fibrates, and cholesteryl ester transfer protein inhibitors did not reduce all cause mortality, CHD mortality, myocardial infarction, or stroke (28). While higher HDL levels are correlated with cardiovascular health, medications used to increase HDL did not improve the health (28). In other words, while high HDL levels may correlate

Table 1: Characteristic features of the study cases

Variables	Patients with SCD*	*p*-value	Control cases
Number	363		255
Age (year)	31.0 ± 9.2 (17-59)	Ns†	31.2 ± 8.6 (16-45)
Male ratio	53.4% (194)	Ns	53.3% (136)
Body weight (kg)	*59.9 ± 11.8 (30-122)*	*0.000*	*71.5 ± 16.4 (40-128)*
Body height (cm)	164.9 ± 9.1 (142-194)	Ns	167.0 ± 8.6 (147-192)
BMI‡ (kg/m²)	*21.9 ± 3.6 (14.3-46.4)*	*0.000*	*25.6 ± 5.8 (15.8-53.5)*
FPG§ (mg/dL)	*92.8 ± 12.5 (57-125)*	*0.005*	*97.6 ± 19.7 (66-269)*
TC ‖ (mg/dL)	*121.4 ± 32.2 (65-296)*	*0.000*	*165.0 ± 54.3 (72-510)*
LDL¶ (mg/dL)	*70.4 ± 28.4 (20-270)*	*0.000*	*102.4 ± 41.1 (29-313)*
*HDL*** (mg/dL)	*26.0 ± 9.4 (4-60)*	*0.000*	*39.6 ± 13.2 (7-95)*
TG*** (mg/dL)	129.4 ± 90.4 (31-1216)	0.000	117.3 ± 107.4 (24-931)
ALT**** (U/L)	27.4 ± 16.2 (4-118)	Ns	27.3 ± 21.6 (6-117)
*Systolic BP***** (mmHg)*	*115.2 ± 15.7 (80-190)*	*0.000*	*122.6 ± 19.4 (80-200)*
Diastolic BP (mmHg)	*73.0 ± 12.3 (50-120)*	*0.000*	*86.6 ± 13.6 (60-120)*

*Sickle cell diseases †Nonsignificant (p>0.05) ‡Body mass index §Fasting plasma glucose ‖Total cholesterol ¶Low density lipoproteins **High density lipoproteins ***Triglycerides ****Alanine aminotransferase *****Blood pressure

with better cardiovascular health, specifically increasing one's HDL values may not increase cardiovascular health (28). So they may just be some indicators instead of being the main actors in human health. Beside that, HDL particles that bear apolipoprotein C3 are associated with increased risk of CHD (29). Similarly, BMI, FPG, DM, and CHD were the lowest between the HDL values of 40 and 46 mg/dL, and the prevalence DM was only 3.1% between these values against 22.2% outside of these limits (30). In another definition, the moderate HDL values may also be the results instead of causes of better human health. Similarly, plasma HDL value was suppressed significantly (39.6 versus 26.0 mg/dL, p<0.000) parallel to the suppressed mean body weight and BMI in the patients, probably due to the severe inflammatory nature of the SCD in the present study.

SCD are inherited hemolytic anemias characterized by the presence of Hb S, which was the firstly discovered hemoglobinopathy in the world (31). Together with hemoglobin E, it is the most common hemoglobinopathy known. Hb S causes RBC to change their normal biconcave disc shape to a sickle shape during various stresses. The RBC can take their normal shapes after normalization of the stressful conditions, but after repeated cycles of sickling and unsickling, hemolysis occurs. So lifespan of the RBC decreases from the normal 120 days to 15-25 days. The chronic hemolytic anemia is mainly responsible for the anemia that is the hallmark of the SCD. Painful crises are the most disabling symptoms of the SCD. Although painful crises may not be life threatening directly (32), infections are the most common triggering factors of the crises. So the risk of mortality is significantly higher during the crises. On the other hand, the severe pain may be the result of complex interactions between RBC, white blood cells (WBC), platelets (PLT), and endothelial cells. Probably, leukocytosis contributes to the pathogenesis by releasing several cytotoxic enzymes. The adverse actions of WBC and PLT on the endothelial cells are of particular interest with regard to stroke and cerebrovascular diseases in the SCD (33). For example, leukocytosis in the absence of any infection was an independent predictor of the severity of the SCD (34), and it was associated with an increased risk of stroke (35). Occlusions of vasculature of the bone marrow, bone infarctions, inflammatory mediators, and activation of afferent nerves may take role in the pathophysiology of the severe pain. Due to the severity of pain, narcotic analgesics are almost always used during the attacks (36). Due to the repeated infarctions and subsequent fibrosis, the spleen is usually too small in adults. Eventually, a functional and anatomic asplenism develops due to the decreased antibody production, prevented opsonization, and reticuloendothelial dysfunction. Terminal consequence of the asplenism is an increased risk of infections with Streptococcus pneumoniae, Haemophilus influenzae, and Neisseria meningitidis-like encapsulated bacteria. Particularly, pneumococcal infections are so common in early childhood with higher mortality rates. The causes of death were infections in 56% of infants in a previous study (34). In another study, the peak incidence of death among children occured between 1 and 3 years of age, and the deaths under the age of 20 years were predominantly caused by pneumococcal sepsis (37). Adult patients, even those who appear relatively fit, are susceptible to sepsis, multiorgan failures, and sudden death during acute painful crises due to the severe immunosuppression in them (38, 39). SCD can affect all vascular organ systems of the body (40, 41). Aplastic crises, sequestration crises, hemolytic crises, acute chest syndrome, avascular necrosis of the femoral and humeral heads, priapism and infarction of the penis, osteomyelitis, acute papillary necrosis of the kidneys, CRD, occlusions of retinal arteries and blindness, pulmonary HT, bone marrow necrosis induced dactilitis in children, chronic punched-out ulcers around ankles, hemiplegia, and cranial nerve palsies are only some

of the several presentation types. Eventually, the median ages of death were 42 years in males and 48 years in females in the literature (12). Delayed diagnosis, delayed initiation of hydroxyurea therapy, and inadequate RBC supports during emergencies may decrease the expected survival time further (42). Actually, RBC supports must be given immediately during all medical or surgical procedures in which there is an evidence of clinical deterioration (43). RBC supports decrease sickle cell concentration in the circulation, and suppress bone marrow for the production of abnormal RBC. So it decreases sickling-induced endothelial damage and inflammation all over the body. Due to the great variety of clinical presentation types, it is not surprising to see that the mean body weight and BMI were significantly suppressed in patients with the SCD ($p<0.000$ for both) in the present study. On the other hand, as an opposite finding to some other reports (44, 45), the body heights were similar in patients with the SCD and control cases,. Probably due to the significantly suppressed body weight and BMI, mean values of the FPG, TC, LDL, HDL, systolic BP, and diastolic BP were also lower in patients with the SCD, which can be explained by definition of the metabolic syndrome (46, 47). On the other hand, the non-suppressed mean ALT value in the SCD patients may indicate hepatic involvement in them (48).

As a conclusion, BMI may be the major determining factor of systolic and diastolic BP in the human body.

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BODY MASS INDEX MAY BE THE MAJOR DETERMINING FACTOR OF PLASMA CHOLESTEROL VALUES

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Abstract

Background: We tried to understand possible effects of sickle cell diseases (SCD) on metabolic parameters including cholesterol values in the plasma.

Methods: All patients with the SCD and age and gender-matched control cases were included into the study.

Results: We studied 363 patients with the SCD (194 males) and 255 control cases (136 males), totally. Mean ages of the SCD patients were similar in males and females (31.1 versus 31.0 years, respectively, p>0.05). Although the body weight and body mass index (BMI) were significantly suppressed in the SCD patients (59.9 versus 71.5 kg and 21.9 versus 25.6 kg/m2, respectively, p= 0.000 for both), the body heights were similar in both groups (164.9 versus 167.0 cm, p>0.05). Parallel to the suppressed mean body weight and BMI, fasting plasma glucose (92.8 versus 97.6 mg/dL, p= 0.005), total cholesterol (TC) (121.4 versus 165.0 mg/dL, p= 0.000), low density lipoproteins (LDL) (70.4 versus 102.4 mg/dL, p= 0.000), and high density lipoproteins (HDL) (26.0 versus 39.6 mg/dL, p= 0.000) values were all suppressed in the SCD patients, significantly. Similarly, both systolic (115.2 versus 122.6 mmHg, p= 0.000) and diastolic blood pressure (73.0 versus 86.6 mmHg, p= 0.000) were also suppressed in them, significantly. Interestingly, only the plasma triglycerides were increased in the SCD patients (129.4 versus 117.3 mg/dL, p= 0.000), significantly. Similarly, mean alanine aminotransferase value was not suppressed in them, too (27.4 versus 27.3 U/L, p>0.05).

Conclusion: The BMI may be the major determining factor of TC, LDL, and HDL values in the plasma.

Key words: Body mass index, total cholesterol, low density lipoproteins, high density lipoproteins, triglycerides, metabolic syndrome, sickle cell diseases

Introduction

Chronic endothelial damage may be the major underlying cause of aging and death by causing disseminated atherosclerosis and end-organ failures in human being (1, 2). Much higher blood pressure (BP) of the afferent vasculature may be the major underlying factor by causing recurrent injuries on vascular endothelium. Probably, whole afferent vasculature including capillaries are mainly involved in the process. Therefore the term of venosclerosis is not as famous as atherosclerosis in the literature. Due to the chronic endothelial damage, inflammation, edema, and fibrosis, vascular walls thicken, their lumens narrow, and they lose their elastic natures, those eventually reduce blood supply to the terminal organs, and increase systolic BP further. Some of the well-known triggering causes or signs of the inflammatory process are sedentary lifestyle, physical inactivity, animal-rich diet, smoking, alcohol, overweight, hypertriglyceridemia, dyslipidemia, impaired fasting glucose, impaired glucose tolerance, white coat hypertension, chronic inflammations, prolonged infections, and cancers for the development of terminal consequences including obesity, hypertension (HT), diabetes mellitus (DM), cirrhosis, chronic obstructive pulmonary disease (COPD), coronary heart disease (CHD), chronic renal disease (CRD), peripheric artery disease (PAD), mesenteric ischemia, osteoporosis, stroke, dementia, various end-organ insufficiencies, aging, and death (3, 4). Although early withdrawal of the triggering causes can delay terminal consequences, after development of the terminal consequences, endothelial changes can not be reversed completely due to their fibrotic natures. The triggering causes and terminal consequences are researched under the titles of metabolic syndrome, aging syndrome, or accelerated endothelial damage syndrome in the literature, extensively (5, 6). On the other hand, sickle cell diseases (SCD) are chronic inflammatory process on vascular endothelium terminating with accelerated atherosclerosis induced end-organ failures and shortened survivals in both genders (7, 8). Hemoglobin S (Hb S) causes loss of elastic and biconcave disc shaped structures of red blood cells (RBC). Probably loss of elasticity instead of shape is the main problem because sickling is rare in peripheric blood samples of patients with associated thalassemia minors, and human survival is not affected in hereditary spherocytosis or elliptocytosis. Loss of elasticity is present during whole lifespan, but exaggerated with inflammations, infections, and various stresses of the body. The hard RBC induced chronic endothelial damage, inflammation, edema, and fibrosis terminate with disseminated tissue hypoxia all over the body (9, 10). As a difference from other causes of chronic endothelial damage, the SCD may keep vascular endothelium particularly at the capillary level (11), since the capillary system is the main distributor of the hard cells into the tissues. The hard RBC induced chronic endothelial damage builds up an advanced atherosclerosis in much younger ages of the patients. Vascular narrowings and occlusions induced tissue ischemia and infarctions are the final consequences of the SCD, so the mean life expectancy is decreased by 25 to 30 years in the SCD patients (12). Actually, the SCD and metabolic syndrome may have similar pathophysiologic effects on human body, and SCD are a chance for us that we can see several consequences of metabolic syndrome on human body in much earlier ages of the patients. We tried to understand possible effects of the SCD on metabolic parameters including cholesterol values in the plasma.

Material and methods

The study was performed in the Medical Faculty of the Mustafa Kemal University on all patients with the SCD and age and gender-matched control cases between March 2007 and June 2016. The SCD are diagnosed with the hemoglobin electrophoresis performed via high performance liquid chromatography. Medical histories of the SCD patients were learnt. A complete physical examination was performed by the Same Internist. Body mass index (BMI) of each case was calculated by the measurements of the Same Internist instead of the verbal expressions. Weight in kilogram is divided by height in meter squared (13). Systolic and diastolic BP were checked after a 5-minute of rest in seated position by using the mercury sphygmomanometer (ERKA, Germany), and no smoking was permitted during the previous 2-hour. Cases with acute painful crisis or any other inflammatory event were treated at first, and the laboratory tests and clinical measurements were performed on the silent phase. A check up procedure including fasting plasma glucose (FPG), total cholesterol (TC), high density lipoproteins (HDL), triglycerides (TG), serum creatinine, alanine aminotransferase (ALT), markers of hepatitis viruses A, B, C and human immunodeficiency virus, a posterior-anterior chest x-ray film, and an electrocardiogram was performed. Eventually, the mean body weight, height, BMI, FPG, TC, low density lipoproteins (LDL), HDL, TG, ALT, and systolic and diastolic BP were detected in each group, and compared in between. Mann-Whitney U Test, Independent-Samples t Test, and comparison of proportions were used as the methods of statistical analyses.

Results

The study included 363 patients with the SCD (194 males) and 255 control cases (136 males), totally. The mean ages of the SCD patients were similar in males and females (31.1 versus 31.0 years, respectively, p>0.05). Although the mean body weight and BMI were significantly suppressed in the SCD patients (59.9 versus 71.5 kg and 21.9 versus 25.6 kg/m2, respectively, p= 0.000 for both), the mean body heights were similar in both groups (164.9 versus 167.0 cm, p>0.05). Parallel to the suppressed mean body weight and BMI, FPG (92.8 versus 97.6 mg/dL, p= 0.005), TC (121.4 versus 165.0 mg/dL, p= 0.000), LDL (70.4 versus 102.4 mg/dL, p= 0.000), and HDL (26.0 versus 39.6 mg/dL, p= 0.000) were all suppressed in the SCD patients, significantly. Similarly, both systolic (115.2 versus 122.6 mmHg, p= 0.000) and diastolic BP (73.0 versus 86.6 mmHg, p= 0.000) were also suppressed in them, significantly. Interestingly, only the plasma TG were increased in the SCD patients (129.4 versus 117.3 mg/dL, p= 0.000), significantly. Similarly, mean ALT value was not suppressed in them, too (27.4 versus 27.3 U/L, p>0.05) (Table 1).

Table 1: Characteristic features of the study cases

Variables	Patients with SCD*	*p*-value	Control cases
Number	363		255
Age (year)	31.0 ± 9.2 (17-59)	Ns†	31.2 ± 8.6 (16-45)
Male ratio	53.4% (194)	Ns	53.3% (136)
Body weight (kg)	*59.9 ± 11.8 (30-122)*	*0.000*	*71.5 ± 16.4 (40-128)*
Body height (cm)	164.9 ± 9.1 (142-194)	Ns	167.0 ± 8.6 (147-192)
BMI‡ (kg/m²)	*21.9 ± 3.6 (14.3-46.4)*	*0.000*	*25.6 ± 5.8 (15.8-53.5)*
FPG§ (mg/dL)	*92.8 ± 12.5 (57-125)*	*0.005*	*97.6 ± 19.7 (66-269)*
TC ‖ (mg/dL)	*121.4 ± 32.2 (65-296)*	*0.000*	*165.0 ± 54.3 (72-510)*
LDL¶ (mg/dL)	*70.4 ± 28.4 (20-270)*	*0.000*	*102.4 ± 41.1 (29-313)*
*HDL*** (mg/dL)	*26.0 ± 9.4 (4-60)*	*0.000*	*39.6 ± 13.2 (7-95)*
TG*** (mg/dL)	129.4 ± 90.4 (31-1216)	0.000	117.3 ± 107.4 (24-931)
ALT**** (U/L)	27.4 ± 16.2 (4-118)	Ns	27.3 ± 21.6 (6-117)
*Systolic BP***** *(mmHg)*	*115.2 ± 15.7 (80-190)*	*0.000*	*122.6 ± 19.4 (80-200)*
Diastolic BP (mmHg)	*73.0 ± 12.3 (50-120)*	*0.000*	*86.6 ± 13.6 (60-120)*

*Sickle cell diseases †Nonsignificant (p>0.05) ‡Body mass index §Fasting plasma glucose ‖Total cholesterol ¶Low density lipoproteins **High density lipoproteins ***Triglycerides ****Alanine aminotransferase *****Blood pressure

Discussion

Cholesterol, TG, and phospholipids are the major lipids of the body. Actually, cholesterol is a waxy substance that is classified as a steroid. It is synthesized by the liver, adrenal glands, reproductive organs, and intestines according to the body needs. It plays a central role in many biochemical processes in human body. For example, it is an essential structural component of animal cell membrane, bile acids, adrenal and gonadal steroid hormones, and vitamin D. Cholesterol crystallizes in the gall bladder and forms the major constituent of most gallstones. Cholesterol is oxidized by the liver into a variety of bile acids. These, in turn, are conjugated. A mixture of conjugated and nonconjugated bile acids, along with cholesterol itself, is excreted from the liver into the bile. Approximately, 95% of the bile acids are reabsorbed from the intestines. By this way 50% of the excreted cholesterol is reabsorbed by the small bowel into the bloodstream again. The excretion and reabsorption of bile acids forms the basis of the enterohepatic circulation, which is essential for digestion and absorption of dietary fats. Cholesterol is kept in balance by homeostatic mechanisms in human body, and cholesterol biosynthesis is directly regulated by the cholesterol levels present. The higher dietary intake leads to reduced synthesis whereas lower dietary intake leads to increased synthesis of cholesterol in the body. Additionally, most of dietary cholesterol is esterified, and esterified cholesterol is poorly absorbed in the body. For these reasons, dietary cholesterol has little effect on plasma cholesterol values. On the other hand, when the cell has abundant cholesterol, LDL receptor synthesis is blocked so new cholesterol in the form of LDL molecules cannot be taken up. On the converse, more LDL receptors are made when the cell is deficient in cholesterol. Cholesterol is found only in foods that come from animals but not in fruits, vegetables, cereals, nuts, and other plants. On the other hand, TG are the fat found in our foods. Most of the fat in the human body is stored in the form of TG again. Calories not burned by the body are automatically converted into TG, which explains why eating too much of anything can lead to excess weight. Fatty acids in stored TG can be removed and used to provide energy for muscles. On the other hand, when stored by the body, TG help to protect and insulate internal organs and cushion the blow of a fall. Actually, the number of fat cells in the body does not fluctuate along with changes in weight instead the fat cells themselves get bigger or smaller. Additionally, TG are the major lipids transported in the blood. In another word, TG provide energy for muscles, are stored as body fat, and are used to produce LDL in the body. TG are composed of even smaller units of fat called as fatty acids that are attached to a chemical base of glycerol. Fatty acids are known as the building blocks of fat. Fatty acids are described as saturated, polyunsaturated, or monounsaturated depending on how much hydrogen they contain. Saturated fatty acids contain the most hydrogen, and they are considered as the most dangerous ones for the health. Interestingly, along with the cholesterol we get from foods, saturated fats can raise the blood cholesterol levels more than anything else in the foods. Saturated fats may increase blood cholesterol levels by slowing down the removal of LDL. Therefore, blood cholesterol values may increase even if the diet

values may increase even if the diet is rich for saturated fats but poor for cholesterol. Foods containing saturated fats mainly come from animals, too. These foods also contain too much cholesterol actually, so they can raise blood cholesterol levels in two ways at the same time. Phospholipids are TG that are covalently bound to a phosphate group. Phospholipids regulate membrane permeability, remove cholesterol from the body, provide signal transmission across the membranes, act as detergents, and help in solubilization of cholesterol.

Cholesterol, TG, and phospholipids do not circulate freely in the plasma instead they are bound to proteins, and transported as lipoproteins. There are five major classes of lipoproteins including chylomicrons, very low density lipoproteins (VLDL), intermediate density lipoproteins (IDL), LDL, and HDL in the plasma. They are classified by their density of protein. The lower the protein, the less dense it is, the higher the cholesterol. The cholesterol within all the various lipoproteins is identical. In another word, there is really only one kind of cholesterol in the body. Chylomicrons are the least dense types of cholesterol transport molecules. Chylomicrons are made of TG, cholesterol, and protein in the intestines, and released into the bloodstream after a meal. Chylomicrons mainly carry exogenous TG from the intestine to the liver via the thorasic duct. VLDL also contains TG, cholesterol, and protein. VLDL are produced in the liver, and mainly carry endogenous TG from the liver to the peripheral organs. In the capillaries of adipose and muscle tissues, 90% of TG is removed by a specific group of lipases. So VLDL are converted into IDL by removal of TG. Then IDL are degraded into LDL by removal of more TG. So VLDL are the main sources of LDL in the plasma. LDL are the major carriers of cholesterol in the blood. LDL deliver cholesterol from the liver to other parts of the body. Although the liver removes majority of LDL from the circulation, a small amount is uptaken by macrophages those may migrate into the inner intima layer of arterial walls and become the foam cells of atherosclerotic plaques. The foam cells are filled with fat and cholesterol. They make up most of plaques. The plaques contain mainly cholesterol, calcium, fibrin, and cellular debris. This process may be accelerated when LDL become oxidized by free oxygen radicals that are produced as a byproduct while our cells are using oxygen to burn fat. Remnants of chylomicrons and VLDL may be able to deposit cholesterol onto artery walls in the same manner with LDL. When TG values are high, there is a larger number of these remnants in the plasma, and a greater risk that arteries are being exposed to their LDL-like effects. Cholesterol that reaches the intima by way of these remnants may be used to produce new foam cells, and that results in more artery-clogging plaque. These remnants may also be vulnerable to oxidation, in which case they pose an even greater threat. Over time these hard deposits thicken the wall of the arteries, forcing blood to squeeze through a narrower space. HDL remove fats and cholesterol from cells including within arterial wall atheroma, and carry the cholesterol back to the liver, adrenals, ovaries, and testes for excretion, reutilization, or disposal. All of the carrier lipoproteins are under dynamic control in the plasma, and are readily affected by diet, illness, drug, and BMI. Thus lipid analysis should be performed during a steady state. But the metabolic syndrome alone is a low grade inflammatory process on vascular endothelium and may be a cause of the abnormal lipoproteins levels in the plasma. Similarly, due to the severe inflammatory nature of the SCD, plasma TC (121.4 versus 165.0 mg/dL, $p<0.000$) and LDL values (70.4 versus 102.4 mg/dL, $p<0.000$) were suppressed parallel to the suppressed body weight (59.9 versus 71.5 kg, $p<0.000$) and BMI (21.9 versus 25.6 kg/m2, $p<0.000$) in the present study. On the other hand, although HDL are commonly called as 'the good cholesterol' due to their roles in removing excess cholesterol from the blood and protecting the arterial walls against atherosclerosis (14), recent studies did not show similar results. Instead low HDL values should alert clinicians about searching of additional metabolic or inflammatory pathologies in human body (15, 16). Normally, HDL may show various anti-atherogenic properties including reverse cholesterol transport and anti-oxidative and anti-inflammatory properties (15). However, HDL may become 'dysfunctional' in pathologic conditions which means that relative compositions of lipids and proteins, as well as the enzymatic activities of HDL are altered (15). For example, properties of HDL are compromised in patients with DM due to the oxidative modification and glycation as well as the transformation of HDL proteomes into proinflammatory proteins. Additionally, the highly effective agents of increasing HDL levels such as niacin, fibrates, and cholesteryl ester transfer protein inhibitors did not reduce all cause mortality, CHD mortality, myocardial infarction, or stroke (17). While higher HDL levels are correlated with cardiovascular health, medications used to increase HDL did not improve the health (17). In another word, while high HDL levels may correlate with better cardiovascular health, specifically increasing one's HDL values may not increase cardiovascular health (17). So they may just be some indicators instead of being the main actors of the human health. Similarly, BMI, FPG, DM, and CHD were the lowest between the HDL values of 40 and 46 mg/dL, and the prevalence DM was only 3.1% between these values against 22.2% outside of these limits (18). In another definition, the moderate HDL values may also be the results instead of causes of the better human health status. Similarly, plasma HDL value was suppressed significantly (39.6 versus 26.0 mg/dL, $p<0.000$) parallel to the suppressed body weight and BMI in the patients, probably due to the severe inflammatory nature of the SCD in the present study.

BP is the force that blood exerts on the elastic walls of arteries. Higher BP indicates that heart and blood vessels are being overworked. In most people with HT, increased peripheral vascular resistance accounts for HT while cardiac output remains normal (19). The increased peripheral vascular resistance is mainly attributable to structural narrowing of small arteries and arterioles, although a reduction in the number of capillaries may also contribute (20). HT is more common in patients with sedentary lifestyle, obesity, alcoholism, and associated

diseases such as DM, CRD, and COPD (21). HT is rarely accompanied by symptoms in short-term. Symptoms attributed to HT in that period may actually be related with associated anxiety rather than HT itself. However, HT may be the major risk factor for CRD, cirrhosis, COPD, stroke, dementia, and PAD-like end-organ insufficiencies in long-term since it damages the inner linings of arteries and sets the stage for atherosclerosis. Plaque deposits are more likely to develop in the areas of damage. If untreated, HT can also increase the heart's workload terminating with CHD. For example, a reduction of the BP by 5 mmHg can decrease the risk of stroke by 34% and CHD by 21%, and reduce the likelihood of dementia, heart failure, and mortality from cardiovascular diseases (22). On the other hand, we can not detect any absolute cause in majority of patients with HT. Physical inactivity, sedentary lifestyle, animal-rich diet, excess weight, smoking, alcohol, chronic inflammations, prolonged infections, and cancers may be found among the possible risk factors of HT. Particularly, excess weight may be the major underlying cause of HT in the world, now. Adipose tissue produces leptin, tumor necrosis factor-alpha, plasminogen activator inhibitor-1, and adiponectin-like cytokines, acting as acute phase reactants in the plasma (23). Excess weight-induced chronic low-grade vascular endothelial inflammation may play a significant role in the pathogenesis of accelerated atherosclerosis in human body (24). Additionally, excess weight leads to myocardial hypertrophy terminating with a decreased cardiac compliance. Combination of these cardiovascular risk factors eventually terminate with increased risks of arrhythmias, cardiac failure, and sudden death. Similarly, the prevalences of CHD and stroke increased parallel to the increased BMI in the other studies (25, 26), and risk of death from all causes including cancers increased throughout the range of moderate to severe weight excess in all age groups (27). The relationship between excess weight, elevated BP, and hypertriglyceridemia is described in the metabolic syndrome (28). Similarly, prevalences of excess weight, DM, HT, and smoking were all higher in the hypertriglyceridemia group (200 mg/dL and higher) in another study (29). Carbon monoxide in cigarette smoke damages the smooth inner surface of arteries. This damage encourages the buildup of plaque on artery walls and makes them hard and narrow. The carbon monoxide molecules hitch a ride on RBC, occupying valuable space that is normally reserved for the oxygen on which the human body depends. In addition to narrowing arteries and taking the place of oxygen in the body, cigarette smoke thickens the blood itself by boosting levels of fibrinogen. Furthermore, smoking may also reduce levels of HDL in the plasma probably due to the systemic inflammatory effects on vascular endothelium. On the other hand, the greatest number of deteriorations in the metabolic parameters was observed just above the plasma TG value of 60 mg/dL in another study (30). Interestingly, plasma TG were the only lipids those were not suppressed instead increased parallel to the suppressed body weight and BMI in the SCD patients in the present study.

SCD are hereditary hemolytic anemias characterized by the presence of Hb S. Hb S causes RBC to change their normal biconcave disc shape to a sickle shape under the effects of various stresses. The RBC can take their normal shapes after normalization of the stressful conditions, but after repeated cycles of sickling and unsickling, hemolysis occurs. So lifespan of the RBC decreases from the normal 120 days to 15-25 days. The chronic hemolytic anemia is mainly responsible for the anemia that is the hallmark of the SCD. Painful crises are the most disabling symptoms of the SCD. Although painful crises may not be life threatening directly (31), infections are the most common triggering factors of them. So the risk of mortality is significantly higher during the crises. On the other hand, the severe pain may be the result of complex interactions between RBC, white blood cells (WBC), platelets (PLT), and endothelial cells. Probably, leukocytosis contributes to the pathogenesis by releasing several cytotoxic enzymes. The adverse actions of WBC and PLT on the endothelial cells are of particular interest with regard to the stroke and cerebrovascular diseases in the SCD (32). For example, leukocytosis in the absence of any infection was an independent predictor of the severity of the SCD (33), and it was associated with an increased risk of stroke (34). Occlusions of vasculature of the bone marrow, bone infarctions, inflammatory mediators, and activation of afferent nerves may take role in the pathophysiology of the severe pain. Due to the severity of pain, narcotic analgesics are generally used during the attacks. Due to the repeated infarctions and subsequent fibrosis, the spleen is usually too small in adults. Eventually, a functional and anatomic asplenism develops due to the decreased antibody production, prevented opsonization, and reticuloendothelial dysfunction. Terminal consequence of the asplenism is an increased risk of infections with Streptococcus pneumoniae, Haemophilus influenzae, and Neisseria meningitidis-like encapsulated bacteria. Particularly, pneumococcal infections are so common in early childhood with higher mortality rates. The causes of death were infections in 56% of infants in a previous study (33). In another study, the peak incidence of death among children occured between 1 and 3 years of age, and the deaths under the age of 20 years were predominantly caused by pneumococcal sepsis (35). Adult patients, even those who appear relatively fit, are susceptible to sepsis, multiorgan failures, and sudden death during acute painful crises due to the severe and prolonged inflammatory process initiated at birth in them (36, 37). SCD can affect all vascular organ systems of the body (38, 39). Aplastic crises, sequestration crises, hemolytic crises, acute chest syndrome, avascular necrosis of the femoral and humeral heads, priapism and infarction of the penis, osteomyelitis, acute papillary necrosis of the kidneys, CRD, occlusions of retinal arteries and blindness, pulmonary HT, bone marrow necrosis induced dactilitis in children, chronic punched-out ulcers around ankles, hemiplegia, and cranial nerve palsies are only some of the several presentation types. Eventually, the median ages of death were 42 years in males and 48 years in females in the literature (12). Delayed initiation of hydroxyurea therapy and inadequate RBC supports during medical or surgical

procedures may decrease the expected survival further (40). Actually, RBC supports must be given immediately during all medical or surgical emergencies in which there is an evidence of clinical deterioration (41). RBC supports decrease sickle cell concentration in the circulation and suppress bone marrow for the production of abnormal RBC. So it decreases sickling-induced endothelial damage and inflammation in whole body. Due to the great variety of clinical presentation types, it is not surprising to see that the mean weight and BMI were significantly suppressed in patients with the SCD ($p<0.000$ for both) in the present study. Probably due to the significantly suppressed body weight and BMI, mean values of the FPG, TC, LDL, HDL, systolic BP, and diastolic BP were also suppressed in the SCD, which can be explained by definition of the metabolic syndrome (42, 43). On the other hand, the non-suppressed ALT value may indicate the hepatic involvement in them (44).

As a conclusion, BMI may be the major determining factor of TC, LDL, and HDL values in the plasma.

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CATHETER-ASSOCIATED URINARY TRACT INFECTION (CAUTI) IN ICU PATIENTS

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Abstract

Background: Catheter-associated urinary tract infections (CAUTIs) are a significant problem in hospitals despite considerable spending on education and prevention. A catheter-associated urinary tract infection emerges when germs enter the urinary tract via a urinary catheter, leading to infection. CAUTIs have been linked with increased mortality, morbidity, healthcare costs in intensive care units. This paper reviews and discusses the most common factors contributing to CAUTI in patients in ICUs and presents the methods and strategies used to reduce ICU-acquired UTIs.

Aim:
To determine how the intensive care unit (ICU) nurses implement infection control to reduce the cases of catheter-associated urinary tract infection (CAUTI) and to find the gaps in the implementation process.

Methods: Using Plan-Do-Study-Act (PDSA) quality improvement methodology, a multidisciplinary team was created to identify ways to reduce Catheter-associated urinary tract infections in ICU. The team reviewed current procedures, protocols, and indications related to catheter insertion. There was a comparison between pre-intervention and after-intervention adherence to catheter bundles for Foley insertion best practice competency and urinary catheter best practice algorithm.

Conclusion: UTI's prevalence within the healthcare settings requires sustained and quality interventions that can be achieved through a quality improvement project. Quality improvement is a structured framework regarding the consistent evaluation of effective health care efforts and practices. It also employs the latest evidence-based practices and requires the collaborative effort and involvement of an entire health care organization. A quality improvement project can help the overall health of the population, reduce UTI associated medical expenditures and in turn diminish the UTI prevalence by utilizing the latest successful practices and methods in scientific literature reviewed in this project. However, to see significant changes, it will take time, continuous education and effort amongst healthcare organizations.

Key words: Catheter-Associated Urinary Tract Infection (CAUTI) ; ICU patients

Introduction

Catheter-associated urinary tract infection (CAUTI) is one of the most common hospital-acquired infections (HAI) in Australia, with nearly 200,000 reported incidents every year (Mitchell, Fasugba, Beckingham, Bennett, & Gardner, 2016). According to Gardner, Mitchell, Beckingham, and Fasugba (2014), 15%–25% of patients admitted to a hospital are catheterized. A report from the World Health Organization (WHO) in 2018 showed that patients who were catheterized had a 5% greater chance of acquiring a urinary tract infection (UTI) for every day they are catheterized. In one month, the chances of acquiring the infection increase to 100%. Indwelling urinary catheters (IUCs) are regularly used in different wards or units in various hospital settings worldwide, but researchers have shown that the use of IUCs is more widespread in intensive care units (ICUs) (Liu, Xiao, & Shi, 2018; Nicolle, 2014).

Moreover, in the United States (US), CAUTIs are the fourth most common infection acquired in a hospital. Also, over 67% of hospitalized patients with urinary tract infections have indwelling catheters (Nicolle, 2014). Patients who are admitted to ICUs are the most at risk of developing UTI due to the frequency and a longer period of IUC use. The chances of a patient acquiring a CAUTI once admitted to an ICU is significantly higher compared to a patient admitted to a different hospital unit (Yukusheva, Costa, Bobay, Parada, & Weiss, 2019). The aim of this project is to determine how the intensive care unit (ICU) nurses implement infection control to reduce the cases of catheter-associated urinary tract infection (CAUTI) and to find the gaps in the implementation process. In order to meet the goal of this project, a learning contract was developed that outlined the objectives and evidence of accomplishments (see Appendix 1). This paper reviews and discusses the most common factors that contribute to CAUTI in patients in ICUs and presents the methods and strategies used to reduce ICU-acquired UTIs. The effectiveness of the strategies are evaluated and an evaluation framework is developed for ongoing monitoring to ensure measures put in place are sustainable. Also, this paper provides evidence of accomplishments using different resources and strategies.

Background

With the prevalence of CAUTIs in ICUs, infection control measures are not only significant but also essential. Rigorous preventive measures should be implemented to inhibit transmission of pathogens. Although the implementation of infection control is the responsibility of all healthcare staff, it relies heavily on the nurses, who have more patient contact and are regularly present at a patient's bedside. Nurses have a significant role in the implementation of policies and procedures that directly impact on the patients. Nurses are also responsible for the maintenance care, infection prevention, and post-removal care of urinary catheters in ICUs. A study by Yakusheva et al. (2019) showed that there is considerable variability in nursing care and practice, and preventing CAUTIs depends on individual nursing skills. In the same study, Yakusheva et al. (2019) cited a mass survey of 1,653 ICUs that was conducted in 965 US hospitals in 2011. The study showed that although hospitals have changed their policies and protocols for infection prevention, it has not routinely translated to bedside practice. There is a similar finding in a published study by Stone et al. (2014), which shows variations in health practitioners' compliance and adherence to the hospital-implemented infection prevention control programs.

According to the Australian Commission on Safety and Quality in Healthcare (2018), although CAUTIs are one of the most prevalent hospital-acquired infections in Australia, they are also the most preventable. Prevention of CAUTIs is essential not only for improving the quality of healthcare but also for reducing the healthcare cost burden. Patients who develop a UTI while in a hospital need to extend the length of their hospital stay, which, in turn, impacts on the patient's health outcomes, their families and the health service. Cases of CAUTIs in ICUs increase the costs not only of hospital care but also of health care in general (Parida & Mishra, 2013). There are modifiable factors that the Australian Commission on Safety and Quality in Healthcare (2018) recommend to prevent or minimize CAUTIs.

Factors contributing to CAUTI in ICU

The first learning objective is to identify and be familiar with the most common factors that contribute to CAUTI in patients in ICUs. In order to meet this objective, it was decided to conduct a literature review of retrospective studies on patients who develop CAUTI in ICUs, identify common pathogens that cause CAUTIs and identify the occurrence of CAUTI in ICUs. A review of the literature provides the core for studies into high-quality medical education, and helps to optimize the significance, uniqueness, generalisability and impact on clinical practice (Maggio, Sewell, & Artino, 2016). Also, the literature review is essential for any researcher to "join the conversation" by giving an explanation, informing scientific method, classifying innovation, eliminating unnecessary research, and guaranteeing professional standards are maintained. The data from the studies that provide evidence of the development of UTIs in patients with IUCs are presented, the common factors that cause CAUTI, the incidence of CAUTI in ICU and the indications for use of a urinary catheter.

Common factors that cause CAUTI

CAUTIs harbour a wide range of bacteria, including multi-resistant organisms. Bacteria colonize the indwelling catheter by forming a biofilm on the interior and exterior surface of the catheter (Nicolle, 2014). Bacterial colonization can begin either from the periurethral region or ascend from the catheter drainage tubing (Nicolle, 2014). It is essential to understand that biofilm formation starts as soon as the catheter is inserted. A single species of bacteria is immediately present following placement of the IUC, and new organisms continue to colonize

the catheter at a rate of approximately 3%–7% per day (Duszynska et al., 2016). Patients on long-term IUCs acquire an additional three to five types of microorganisms (Nicolle, 2014). The microorganisms that are commonly isolated are *Escherichia coli*, Enterococci spp, Candida spp, *Pseudomonas aeruginosa, Klebsiella spp, Proteus mirabilis, Acinetobacter baumannii, Morganella morganii, Staphylococcus aureus,* and coagulase-negative staphylococci (Duszynska et al., 2016; Nicolle, 2012, 2014).

In addition, the Centers for Disease Control and Prevention (CDC) and National Health Care Safety Network (NHSN) criteria for a CAUTI are that the patient has had an indwelling urinary catheter (ICU) for more than two consecutive days, has developed a fever of >38°C and has a positive urine culture of at least one bacterium of $>10^5$ CFU/ml (Al Nasser et al., 2016). Several other studies illustrated that an increased duration of catheterization has been identified as a significant factor associated with the acquisition of CAUTI (Dublynn, & Episcopia, 2019; Medina et al., 1997; Plat et al., 1996). The occurrence of bacteriuria while the urinary catheter is in place is inevitable (Davies et., 2018). Also, a study done by Lee (2017) identified that diabetes is a factor in CAUTI development, and numerous other studies have confirmed diabetes as a factor in the development of UTIs. Rousseau et al. (2016) noted that impaired granulocyte function in patients with diabetes, increased adhesion of uropathogens to bladder epithelial cells, and the impacts of glucosuria on the development of uropathogens in diabetic patients make a significant contribution to a higher incidence of UTI.

Incidence of CAUTI in ICU

IUCs are commonly used on patients in ICUs to measure the fluid intake and urinary output of patients who are critically ill. A study by Allen et al. (2014) claimed that inserting a urinary catheter is an essential step in the patients' admission process in ICUs. Allen et al. (2014) asserted that a catheter's insertion is almost an automatic intervention for everyone admitted to an ICU. Allen et al. (2014) further argued that nurses prefer to leave a urinary catheter intact until the patient is discharged from the ICU.

Furthermore, several studies have consistently proven that the placement of an IUC increases the likelihood of developing CAUTIs and can result in further complications such as sepsis (Duszyńska et al., 2016; Liu, Xiao, & Shi, 2018; Nicolle, 2014). In 2015, in Australia and New Zealand, 30.2% of patients with urinary tract infections developed sepsis; in Canada and the US, it was 14.7%; in Saudi Arabia, it was 18.3%; and in France, this percentage was 8.4% (Duszyńska et al., 2016). Similarly, a comparable study by Rosenthal et al. (2011) reported that in 10 developing countries, the risk of dying for patients who contracted CAUTIs could increase to 15%.

Indication for a urinary catheter

IUCs are inserted to collect a urine specimen from a patient (WHO, 2018). In Gazarin et al.'s (2020) study, a rural hospital in Canada, Winchester District Memorial Hospital, performed an audit to measure the appropriate use of a urinary catheter in their hospital. The audit found that 31%–41% of patients catheterized did not meet the guidelines of the US Center for Disease Control and Prevention (CDC). Also, a study of seven ICUs from different regions in Japan found that in 76% of patients who were catheterised, only 54% were indicated for appropriate use (Kuriyama et al., 2017). In this study by Kuriyama et al. (2017), measuring the patient's fluid input and urinary output was identified as the most common inappropriate reason for IUC insertion. In Japan, however, the nurse can determine which patient will be catheterised because the placement of a urinary catheter does not require a physician's approval.

Consequently, indwelling urinary catheters are frequently used in ICUs to measure the fluid input and urinary output of critically ill patients. Other indications are for perioperative use and sustained immobility (Kuriyama et al., 2017). The WHO (2018) has set guidelines and criteria that advise on indwelling urinary catheters' appropriate use. IUCs are recommended for patients with bladder obstruction, urinary retention, or difficulty passing urine due to a neurological disorder, for precise urinary output measurement, as a particular perioperative procedure, when there is prolonged immobilisation due to multiple trauma, and to assist with end of life support.

Strategies for Reducing CAUTI

The second learning objective is to understand the methods and strategies that hospitals utilise to reduce CAUTIs in patients and to evaluate the effectiveness of these methods. In order to meet this objective, online journals and databases were used as tools to further collect information from studies in different hospitals, both local and international. Many clinical situations are suitable for catheter placement, but they are used too frequently without proper guidelines and continue longer than is necessary. This method was chosen in order to provide evidence that CAUTI is a largescale issue in many hospital settings. The other learning objective is to identify and recognise the role of nurses in the implementation of hospital policies and procedure for the process of inserting a urinary catheter in patients. In order to meet this objective, the project included a review of studies that show the current role of nurses in hospitals in relation to IUCs and the associated infections. What follows below is a review of the literature that describes various methods and protocols that hospitals have implemented to prevent and reduce the occurrence of CAUTIs and the role of nurses in the prevention of CAUTI.

Hospital Policy and Guidelines

Hospitals and ICUs have methods and strategies for reducing the incidence of CAUTIs. One way to reduce the incidence of CAUTI is to implement hospital policy and guidelines, such as by applying the CAUTI care bundles. The project guidelines included a catheter discontinuation policy, bladder management, introduction of a CAUTI investigation tool, standardisation of perianal care before catheter insertion, staff education, an educational toolbox specifically for CAUTI presenting the rates of CAUTI to stakeholders monthly. However, Allen et al. (2014) argue that implementation practices and changes in hospital protocols and policies do not ensure that there will be a decrease in the incidence of CAUTIs, as often there are challenges in the organisation, and its culture can hinder clinical outcomes and improvement.

The Ann Arbor Criteria for Appropriate Urinary Catheter Use provides a guide for the appropriate use of urinary catheters (Meddings, Fowler, Saint, & Fowler, 2015). The criteria include specifics on the guidelines to measure the fluid input and urine output of patients. Monitoring urine volume is clinically indicated for patients who are severely ill, and includes (1) haemodynamically unstable patients who require hourly medication adjustment; (2) acute respiratory patients who require aggressive ventilation with hourly adjustment of diuretics; and (3) patients who require hourly monitoring of urine studies to manage life-threatening laboratory abnormalities (Meddings et al., 2015).

Education and Technology Utilisation

Another approach that hospitals implement is the education of ICU staff. Technology, such as electronic prompts, is used to enhance staff awareness and provide education (Bell, Alaestante, & Finch, 2016). Electric prompts are also utilised to monitor IUC use and current patients who have a urinary catheter – the project was reported to be an effective intervention (Bell et al., 2016). The mechanism of the electronic prompts works by asking healthcare practitioners before the procedure about the indication for IUC placement (Bell et al., 2016). It also tracks patients with a urinary catheter, as tracking patients who have an IUC daily alerts nurses and doctors to which patients have a urinary catheter and its placement duration (Bell et al., 2016; Sauter, 2012). This strategy has helped decrease the days that a patient needs to have a urinary catheter and reduces the risk of developing a urinary tract infection (Sauter, 2012). Also, Electronic Medical Records (EMRs) can track patients who have an IUC and provide a reminder to healthcare providers (Sauter, 2012). The EMR prompts nurses to assess the patient and justify IUC placement. The EMR also requires nurses to document the presence of a catheter at every shift.

Utilisation of CAUTI Care Bundles

The USA Institute of Healthcare Improvement and the United Kingdom Health Department have suggested several 'care bundle' strategies for preventing CAUTIs (WHO, 2018).

Insertion Care Bundle

Avoid unnecessary catheterisation

Choose catheters of appropriate size

Use sterile items/equipment

Insert catheter using a strict aseptic non-touch technique

Use a closed drainage system

*Adapted from WHO (2018) guidelines on prevention of catheter-associated urinary tract infection

Maintenance Care Bundle

Review the need for the catheter on a daily basis and remove the catheter promptly when no longer necessary

Use an aseptic technique for daily catheter care (e.g., hand hygiene, sterile items/equipment)

Do not break the closed drainage system. If a urine specimen is required, take the specimen aseptically via the sampling port

An eight-year study at King Abdul-Aziz Medical City, Saudi Arabia by Al-Hameed et al. (2018) reported success in reducing CAUTIs using the 'care bundle' approach. The bundle guidelines were reported to be effective in infection control and reducing the rate of CAUTIs in an adult ICU. The researchers' primary strategy was creating a multidisciplinary team that educated the staff and monitored and identified the appropriate indications for the use of an IUC. The hospital also used a standardised maintenance form for documentation of the removal or renewal of a patient's IUC. The nurse unit manager in the ICU monitored the number of urinary catheters in use in the ICU, and there was also a team who conducted surveillance regularly. The combined strategies and team collaboration lowered the number of incidences of CAUTI in the adult ICU.

Nurse's role in CAUTI prevention

The following sections present information on the potential role of nurses, nurse leaders and nurse educators in reducing CAUTIs and identifies strategies used by researchers to address the issue of CAUTIs.

Nursing responsibilities in CAUTI prevention

The role of nurses in reducing CAUTIs is essential and can significantly impact the overall process of IUC placement. The nurses directly care for patients and overall have the general impression and understanding of a patient. Sauter (2012) stated that nurses could recognise when

the patient no longer requires a catheter and is able to communicate this observation to the doctor, who can order the catheter removal. Early removal of a catheter has been proven to reduce the risk of CAUTIs (Sauter, 2012). Despite protocols in place to guide staff in removing the catheters, researchers have found that many nursing staff are still hesitant to timely remove a patient's catheter (Gazarin et al., 2020; Sauter, 2012).

Nursing leader responsibilities

A nurse-driven system to decrease the number of CAUTIs acquired from the hospital is effective and efficient for a community hospital (Quinn, 2015). Clinical leadership is vital in nursing as it equates to high-quality patient care. Every healthcare setting aims to empower staff to take initiatives, be proactive, and be willing to learn and improve their skills and knowledge. According to Daly, Jackson, Mannix, Davidson, and Hutchinson (2014), clinical leadership is not exclusive to any particular group, but instead, every member of the healthcare team has the potential to become a leader. Developing clinical leadership skills then means that it is not only the healthcare professional's effort alone that develops these skills, but it is also the result of the influences from the people they work with (Xu, 2017). Also, nursing leaders are assigning a nurse champion to monitor catheter use in the ICU, accurately identify patients at risk, review interventions, and educate staff on preventing CAUTIs, all of which are among nurses' various roles (Russell, & Watters, 2019).

The nursing leaders implementing daily rounds is an excellent way to educate other nurses about protocols, review medical records, and check if patients with urinary catheters have an order to keep the catheter in place (Gazarin et al., 2020). A nurse-to-nurse discussion on whether the catheter is still indicated for the patient can also be beneficial (Sauter, 2012).

Nursing educators' responsibilities

Effective CAUTI prevention must identify all catheter care components through continued training, utilising multi-faceted techniques, and everyone taking part in catheter care. Nursing educators have a significant role in preventing CAUTIs due to their responsibility of educating nurses about the issues surrounding catheterisation, as this can increase their awareness and improve their perception of the issue and promote autonomy and confidence as advocates for patients (Sauter, 2012). Nevertheless, there is a gap in knowledge about catheter use among nurses that potentially impacts the nurse's role in preventing CAUTIs. Yoon et al. (2013) proposed a solution to educate nurses, provide an opportunity for nurses to lead, and recognise their work and effort through a simple reward system. It has been shown that empowered ICU nurses help to decrease the number of days a urinary catheter is in place. Nurses provide education to patients and family about the need for the IUC and discuss alternative options for patients such as using condom catheters (Gazarin et al., 2020; Sauter, 2012). Furthermore, Yoon et al. (2013) added that the creation of a catheter curriculum that aims to increase awareness among nurses and includes information about essential microbiology, infection control, and hand hygiene practices is an excellent starting point in enabling the clinical team to be proactive in catheter care and surveillance. The education team should be comprised of clinical nurse leaders, educators, and doctors.

Evaluation

The third learning objective is to develop an evaluation framework for ongoing monitoring to ensure that measures put in place are sustainable. An evaluation framework of clinical practice and practice change can significantly improve patient safety (Parker et al., 2017). Part of developing an evaluation framework is evaluating the process measures. According to Sharma et al. (2017), evaluations of the process intend to understand and evaluate how an intervention is carried out. Process evaluations can also facilitate answering what the primary active intervention is and what emerging adaptations are needed.

Moreover, part of the evaluation framework is a quality improvement tool, Plan, Do, Study and Act (PDSA). The intent of the PDSA method is to understand as quickly as possible whether a procedure works in a specified environment and to make adjustments to increase the likelihood of providing and sustaining the desired improvement accordingly.

Process Measures

The primary measure of the process will be a re-examination of the catheter necessity at the time of insertion and for each day of use with the goal that ≥95 per cent of indwelling catheters would meet the bundle's ≥1 indication(s). For use at unit-specific quality improvement meetings, the improvement advisor generated monthly, and annual compliance reports in ICU. During the evaluation, PDSA cycles will be developed to facilitate and measure daily assessment of catheter necessity. As part of our plan, catheter necessity monitoring will be conducted daily in ICU. Unit champions will be identified, trained and granted the responsibility of discussing the necessity of an indwelling catheter in daily rounds with the patient care team. When no indication is identified, the patient care team will explore the possibility of removing the catheter. To identify compliance with the critical bundle measure, unit charge nurses will assess the presence and indication for a urinary catheter for all patients on their unit daily. Moreover, these data that will be gathered will measure the impact of the PDSA cycles.

PDSA

The Plan-Do-Study-Act (PDSA) cycle is a component of the Institute for Healthcare Improvement improvement model and is a simple yet powerful tool for accelerating quality improvement (IHI, 2017). PDSA has become the most frequently used process improvement model and

involves completing the sequences, then repeating the process until the desired results are achieved (Tichnor-Wagner et al., 2017). CAUTIs comprise one of the most common HAIs in hospitals worldwide. Also, there are changes in the prevalence of cases. PDSA is the most suitable model for long-term management of CAUTIs in hospitals because it provides for any changes that may arise with new circumstances of infection.

Plan

The planning phase involves establishing the targets, processes and action plan to deliver the desired results. The creation and implementation of a multidisciplinary CAUTI prevention plan will reduce CAUTI infections. The plan would be a blueprint on how to implement the process improvement for CAUTI prevention. A performance measurement plan would also be in place in the ICU. A plan should be developed for integrating CAUTI risk prevention strategies into the processes of the ICU.

DO

The multidisciplinary team would include personnel from all the departments concerned. Successful CAUTI prevention teams include the team leader, the champions of nurses and physicians, executive partners, frontline nurses, planners or case managers for infection prevention and discharge, and risk managers in the ICU. In addition to being in charge of CAUTI management, the team of planners would give annual, weekly, and monthly reports on the progress of their undertakings. They would also be responsible for educating the staff and patients and their families about the prevention of CAUTI infections.

Finally, in ICU, they will be responsible for case risk assessments and risk scoring. Secondly, a weekly CAUTI risk meeting will be held by the CAUTI prevention team, all the staff, and the patients, especially in the acute care unit. All case and risk reports will be sent on a weekly, monthly, and yearly basis to the persons concerned, such as department managers, patients, and hospital management. A committed risk management head of CAUTI in ICU shall be appointed to manage all cases, including treatment and prevention. The preventive measures would be based on evidence-based measures, including urinary catheter care during placement, timely removal of urinary catheters based on nurse-driven processes, and inappropriate prevention of short-term catheter use.

STUDY

The phase would involve assessing and analysing the incident monitoring reports and other scoring tools to determine whether any positive results have been achieved by all of the prevention strategies for CAUTI in the ICU. Patients and their families, facility staff, prevention committee, hourly-round feedbacks, and other necessary information will be collected.

ACT

The phase would involve acting on the results or outcomes obtained from the previous phase and making any reasonable and appropriate changes. For example, if the current procedures have not been successful, the unit would have to fine-tune the preventive actions to significantly improve the positive outcomes or find other CAUTI prevention strategies

Key Learning

In the literature, most quality improvement projects resulted in a significant reduction in the incidence of CAUTIs. Other studies, however, did not show significant changes, mainly because of the challenges of adopting new culture and practices. Although these projects had a potential role in decreasing CAUTI, compliance from the staff was not sustainable, and the expected changes were short-lived or not long enough to gain potential benefits. The support of the organisation and provision of resources were also reported to have an impact on staff motivation. All the studies identified challenges with the introduction of new protocols, in particular, the extra time required for the clinical staff to adopt a new hospital culture. The clinical champions mentioned in one of the studies were useful in motivating other staff and serving as a leader for their peers. Ultimately, every nurse has the potential to become a nurse leader in their field of expertise. Education and team collaboration are critical factors in developing leadership. A nurse has direct contact with a patient and can influence their health outcomes. Adding leadership to the nursing skills and intervention can ensure the provision of high quality, efficient care of the patient.

Conclusion

Catheter placement is a multidisciplinary decision and not the sole responsibility of nurses. Although the placement of an IUC is inevitable in many cases in ICU patients, it is entirely feasible to decrease CAUTIs through collaborative interventions. The best guideline that the healthcare professional can use to prevent CAUTIs is to limit the use of a urinary catheter and only use when there is a clear indication for usage. Also, getting the catheter removed as soon as it is not required is just as necessary. Following the hospital guidelines and practising a proactive attitude and evidenced-based care promise a positive health outcome for any patient. Finally, utilising a quality improvement tool like PDSA will impact on the sustainability of the improvement plan. Nonetheless, this project's limitation is the inability to evaluate potential confounding risk factors for CAUTI, including antibiotic exposure, because our data were primarily collected for surveillance purposes. Also, small sample size affects the reliability, and a pre-and-after design had been utilized, which is susceptible to unmeasured confounding variables.

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Appendix

Learning Contract Project

Contract aim:

The aim of this project is to determine how the intensive care unit (ICU) nurses implement infection control to reduce the cases of catheter-associated urinary tract infection (CAUTI) and to find the gaps in the implementation process.

Background:

Urinary tract infection (UTI) is widespread among intensive care unit patients and 60% to 80% of the cases are due to indwelling urinary catheters (Liu, Xiao, & Shi, 2018).To determine how infection control is implemented, this project will review literature that describes the incidence of UTIs in the ICU setting, the risk factors, and the effectiveness of prevention measures. Cases of CAUTIs in ICUs increase the costs not only of hospital care but also of health care in general (Parida & Mishra, 2013). Identifying the gap in infection control implementation will help to determine which evidenced-based strategy implemented by ICU nurses has the most impact in reducing CAUTIs.

Learning Objectives	Learning Resources and Strategies	Evidence of Accomplishment
Identify the duration before ICU patients acquire a UTI from the time the indwelling catheter (IDC) is inserted Determine the indications of IDC use on the ICU patient	Review journals and studies and identify cases of UTIs in the ICU setting Identify the common pathogens. Identify how frequently infection occurs and determine how long it takes to acquire a UTI after IDC insertion. Show evidence or report on the use of IDCs on patients although not indicated	Evidence that shows the cases of patients that have acquired UTIs while in ICU. Identify the factors that contribute to developing UTIs through literature review. The evidence will also show the possible strategies that can be used to minimise the incidence of UTIs in patients who are in the ICU. 1000 words
Identify the methods and strategies used to reduce ICU-acquired UTIs and evaluate the effectiveness of the strategies. Determine the role of nurses in reducing CAUTIs	Journals Books Databases: PubMed, Medline, Cochrane library Semi-structured interviews with ICU nurses.	Review of literature that describes the strategies used by nurses to decrease UTIs in ICU. Identify hospital policies and protocols. Identify the role of nurses in reducing CAUTI 1250 words
Develop an evaluation framework for ongoing monitoring to ensure measures put in place are sustainable	Databases: PubMed, Medline, Cochrane library Data gathering	Assess the success of the implementation programs by identifying the number of ICU patients on IDC who did not develop a UTI using the PDSA framework. Assess the cases that developed a UTI despite the strategies implemented. Evaluate the strategy and propose a recommendation. Determine if the methods are applicable to other clinical settings besides ICU. 1250 words.

HORMONES BLOCKAGE AND GENDER REASSIGNMENT

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I must admit when I read the phrase of hormone block in young children, I felt some sort of great disgrace, disbelief and could not digest or absorb the real meaning behind it. I started search to read around it and learn what is the essence of all that. I started to question, what world are we living in and how can we play or manipulate with our own biological and genetic make-ups, without a valid verdict or justification. How can a child decide to block his or her hormones, to assign the gender they want to be, when they are still young, immature and probably still cannot decide or be certain, for their future ahead?

I think the whole idea is basically clouded by many factors spiralling, bombarding and going around us and it is getting it is tremendously impacting grossly on young people. I read a story of a young girl who regretted the irreversible transformation and makeover procedure and accused the hospital for not explaining the full action underpinning in full disclosure. She later on, reverted back to her own inborn identity as she mentioned. This girl seemed to have major issues about her gender identity and decided to change to a boy without knowing the profund consequences incurred subsequently. In fact, little is still known in regards, and the evidence base is quite infantile and poor.

She added that it was an unlawful action that left her in demoralised, with low moods and suicidal ideations. She affirmed that the conducting doctor had rushed her and did not carry out a proper investigation to assess if her mental health was deranged or sound at a time, when she was diagnosed with gender dysphoria and wanted a gender reassignment.

In the UK, the law allows anyone from age of 13 onward, to consent for any procedure even if the parents object according to Gillick concept. It is merely to respect autonomy genuinely shall it raise. This concept has been devised long time ago in the UK when an outraged mother disagreed about a treatment given to her teenage pregnant girl and was escalated to court at a time. The concept deemed those under 16 are mature enough to understand the nature and implications of any clinical treatment or a procedure to be undertaken, as an autonomous adult without their parental approval. Sometimes, this argument would look to be disputed as to if this child was mature enough to opt for themselves or not.

Gillick competency implies that understanding, retaining, communicating effectively the passed-on knowledge, in order to satisfy their full mental capacity and competency, to make a sound decision for their best interest. However, at this age, it would be wise to ensure that they understand fully the whole procedure; with what it involves and how it will be conducted and give them some time, to take the information in, to rethink, to digest the whole picture and to reflect back if they are quite sure and happy about it, as its irreversible process in many instances. It has been found that those children when they start developing their puberty, will not go through this and will stay as they are biologically born and defined.

'Gender dysphoria' is defined by the NHS, as a condition where a person would experience extreme distress and discomfort as there is a mismatch between their actual inborn biological sex and the feeling of their gender identity. It is also called gender incongruence.

'Hormone block' is a treatment to be given, to help people live the gender they want to be, with their preferred one, and in the body, they wish to have. It involves certain hormones to play with and manipulate; halt, stoppage, give and change. The whole idea and procedure have been started in 2011 in the UK, London, by Tavistock's experiment. However, it was originally started and adopted by Amsterdam Gender Clinic, in 1994, when a 16-year-old girl wished to be a boy. She was given a Gonadotropin releasing hormone agonist (GnRHa); a hormone which originally was given to treat prostate cancer, sexual deviance in men and in precious puberty to halt it (Biggs M, 2019). Then the Gender Identity Development Service (GIDS), part of Tavistock and Portman NHS Foundation Trust, started treating children with gender dysphoria from England, Wales and Northern Ireland. They launched a puberty blockers experiment, in 2011; a version of GNRHa regime. The experiment involved injecting 44 children with triptorelin. Parents and children were not informed fully about the risks of triptorelin. Additionally, the negative results of the experiment were not published according to Biggs M, 2019, report. In his report it is clearly made that some had denounced the use of hormone blocker and it is long term effects on the body system including the bones. Some campaigns had gone far and expressed their argument by expressing that having anything was

better rather than living in the wrong body, which made the demand on hormone blocker immeasurable.

The experiment was approved by one committee without having controls and the children were invited to sign and complete a questionnaire. It seems that this drug has never been licensed for this condition anywhere globally. Additionally, the evidence base is quite poor around it. The review did not explicitly explain how it will affect bones, height, gonads and body shapes and it is reversibility.

Scientifically when puberty is suppressed for a period of time, the bones will stop growing, and will not get stronger enough as they supposed and meant to be and it is not clear how it will affect the developing brain at that period of teenage growth. Clearly it is totally unknown. Additionally, the Tavistock deemed it is a reversible process as a press of a button, which will not reflect the actual reality, but indictment along with surgical correction ultimately.

Furthermore, side effects were not addressed in the consent sheet, such as depression, headaches, hot flushes, abdominal pain, bruising, redness and swelling, weight gain, acne, hypersensitivity reactions and irreversible infertility. Moreover, the trauma of shunted gonads would incur certain psychological and social issues. Added to the hurdles of physical and the developmental life-long consequences. Those all shortfalls and misleading information's will contribute certainly and are considered a serious ethical misconduct in medical ethics.

What is more, the criteria for children age selection were fluctuating between 10-16 and did not follow the ethics committee approved criteria according to Brigg M, 2019 report. This in fact reflect profound discrepancy and a serious breach. One of the cases were followed up in the Dutch experiment to the age of 35 who did not regret the change but scored high for depression and could not sustain a romantic relationship and felt shame about his physical external genitalia appearance.

To understand the whole process of this conduct. The hormone block follows three main stages, where it starts with puberty suppression (whereby the child will have the time to think, reflect and decide if to go ahead with the body they wished and wanted to feel ease with), passing through gender-affirming hormone and ending with gender affirming surgery. The Gender-reassignment surgery, is the final step in transitioning from one sex to another, and is reserved for patients over 18 after a year of the cross-hormone intake. This involved surgical cut and reconstruction of the gender wished to be in simple terms. It would involve, bilateral mastectomy, nipple repositioning, dermal implant, hysterectomy, salpingo-oophorectomy and so on and for the other gender it would involve orchidectomy, penectomy, vaginoplasty, vulvoplasty and construction of a clitoris (clitoroplasty). And the rest would be the reverse to the other wanted gender, as for instance, construction of a penis (phalloplasty or metoidioplasty), construction of a scrotum (scrotoplasty) and testicular implants and a penile implant. Anyone would read that, would think it is as simple as that and in fact, it is not, as it is a major big change with great transformations and implications on the long run.

The hormone block involves fundamentally blocking the normal secretion of the biological one and opposing it, by introducing the counteract hormones (called as cross-sex hormones- gender-affirming hormones) of the desired gender. This will lead to irreversible changes such as breaking or deepening of the voice, breast development and infertility. Those hormones affect people differently. Also, there is some uncertainty about the cross-sex hormones risks on the long-term, and they are supposed to be taken for life even after the gender affirming surgery to keep the momentum rolling over.

This process has been and still taken place at Tavistock and Portman NHS Trust of the UK, in London. The girl exclaimed that the whole process was a traumatic emotional experience and there is no way going back in time, as the clearly made physical changes were visible for ever. She added that she kept felt for years as everything else was shutting down, falling apart, bringing up, as a menopause state and realised the gender reassignment thing was a complete hoax, full of negative feelings and sickness in her life to come.

While the science has observed in certain medical conditions, there is a mix between both genders, as in congenital adrenal hyperplasia. Research found that 1% who suffered gender dysphoria, which means it is a rare find and the whole process is tedious and frustrating to children at such an earlier age. However, due to the publicity and growing awareness of such attitudes, could possibly bring in such behaviour with younger children ahead in the current time and future to hold.

Having said so, it is not clear though how those experiments can affect their life in many aspects. Those drugs no doubt could cause substantial harms on their mental, physical life and thus affect the quality of their life in many shapes and forms. Beside the facts of their well-known side effects, such as predisposing to blood clots risk, gall bladder stones, weight gain, dyslipidaemia and liver enzymes derangements, polycythaemia, androgenic alopecia and acne. All of which can be added to the long list of drawbacks and risks stated above.

The whole idea of enabling a child to changing sex came from children and parents along with the transgender activists and some clinicians, to promote the GnRHa. Negative results were not published like the self-harms, behavioural and emotional problems, which imply exacerbating gender dysphoria.

Before the whole story for hormone blocker for young people with gender dysphoria, they will grow out naturally becoming gay, lesbian or bisexual adults. Hormone blocker clearly destroy the ability to conceive and to have orgasm which is a strong taboo to discuss.

Some psychologists have stated that those children are over-diagnosed and then over-medicalised, and this could create a laborious medical scandal.

After all, medicine and good medical practice condemn inflicting any harm and any ill act that will put or risk anyone life, so how about such strong hormones without a prior good knowledge to their implications and their morbid impacts on the long run when misused. The question is, how can we play with our natural development under many misnomers, and names? This will create a void community in the future thinking of nonsense and let commercial companies just to breed in and make more interests and profits out of that.

In light of the above, your body is your property and it should not be handled or missed up or extremely mutilated in such a way. It is your identity, your path and should be respected and reserved carefully unless it is a pathological issue without your control incurred like in certain well-known diseases. Most of who had this lengthily journey had apparently regretted and considered it a confused moment in their darkness moment.

The UK high court took this serious matter further and decided to stop referral of children under 16 for puberty blockers, on the argument that such children were improbable to fully recognise the long-term repercussions. Therefore, this came into effect by the end of 2020 and shall stay so until an appeal should it be raised by the UK's only gender identity development service; the Tavistock and Portman NHS Foundation Trust (Bmj, 2020). Additionally, the only gender identity development service has been deemed and rated to be inadequate by the care quality commission (CQC) of England, and has imposed conditions on the Tavistock and Portman Trust's registration, in order to diminish the long waiting list of nearly 4,600 young people (BMJ, 2021). The claim came as those patients are vulnerable and their risks cannot be monitored nor assessed, and they cannot take up their concerns to the next level without the fear of retribution, to quote theirr argument exactly.

This case is still ongoing and the debate is quite challenging and hot; we wait to witness the battle and its outcome.