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P.O.Box: 37444 Tel: 00967 1 675567 Fax: 00967 1 675885
E-Mail: journal@andalusuniv.net
Web Site: www.andalusuniv.net

Issue: Volume (9)-No(3) January 2015

ISSN: 2410-7727 ISSN: 2410-7735

البحث المنشورة في هذه المجلة تعبر عن آراء أصحابها وتعبر عن رأي المجلة أو الجامعة (AUST)
القواعد العامة وإجراءات النشر

أولاً: القواعد العامة:

- يقبل نشر البحوث باللغتين العربية والإنجليزية، في مختلف فروع العلوم الإنسانية والتي تتوافر فيها الشروط الآتية:
  1) أن يكون البحث أصيلًا وتتوافر فيه شروط البحث العلمي المعتمد على المنهجية المتعارف عليها في كتابة البحوث العلمية.
  2) أن يكون البحث مكتوبًا بلغة سليمة مراجعة دقة الحروف والأشكال وبخطوط (Traditional Arabic) متوافقة مع اجهزة (IBM) بينط (16) وبخط (والألا) يزيد عدد صفحات البحث عن (30) صفحة متضمنة البوامش والمراجع.
  3) أن تكون الجداول والأشكال والآيات القرآنية مدرجة بأشكالها الصحيحة وأن تشمل العنوان والبيانات الإيضاحية الضرورية بدون استخدام أي برامج مساعد.
  4) أن يكون البحث ملتزماً بدقة التوثيق وحسن استخدام المصادر والمراجع وتشبيتها

- عند استخدام الكتب بوصفها مراجع للبحث، يتم كتابة اسم المؤلف كاملاً، ثم يوضع تاريخ النشر بين (عاصرين)، يلي ذلك عنوان الكاتب وتم وضع تحت خط، ثم يذكر اسم دار النشر وممكان النشر ورقم الصفحة.
- عند استخدام المجلات (المجلات) باعتبارها مراجعًا للبحث، يذكر اسم صاحب المجلة، ثم يذكر اسم المجلة وتحته خط، ثم رقم المجلد، ثم رقم العدد ورقم الصفحات.
- لا يمكن البحث قد سبق نشره أو قدم للنشر لأي جهة أخرى.
- رسوم النشر تقدر بـ (15) خمسة عشر ألف ريال يمني للليميني، وب(100) مائة دولار أمريكي لغير اليمنيين ترسل إلى حساب الجامعة عبر حواله بنكية عبر بنك التضامن الإسلامي الدولي (فرع حده) بحساب رقم (203) سوفيت صعود (TIBKYESA101) أو عبر تحويل المبلغ عن طريق شركة (ويسترونو يونيون) (Western Union).

العدد (5) المجلد (9) يناير 2015م
ثانياً: إجراءات النشر:

- ترسل البحوث وجميع المقالات المتعلقة بالجلالة إلى عنوان المجلة عبر البريد.
- أو إرسال البحوث بالبريد الإلكتروني الخاص بالمجلة.
- يرفق بالبحث ملخص للبحث (حوالي 100 - 150 كلمة) باللغة العربية واللغة الإنجليزية.
- يرفق بالبحث سيرة ذاتية مع تحديد التخصص الدقيق الذي ينتمي إليه الباحث مع وضع العناوين بالتفصيل مع توضيح العناوين البريدية مع ارقيم الهواتف الإضافية والجوال والفاكس.
- في حالة قبول المبدئي للبحث يتم عرضه على محكمين من ذوي الاختصاص في مجال البحث، ويتم اختيارهم بسعيه تامي، ولا يعرض عليه اسم الباحث أو بياناته، وذلك لأخذ آراءهم حول مدى اصله البحث وقيمتته العلمية، ومدى التزام الباحث بالمنهجية المتعارف عليها، والمحكم هو من يحدد مدى صلاحية البحث للنشر في المجلة من عدمه.
- يخطر الباحث بقرار صلاحية البحث للنشر من عدمه خلال شهر على الأكثر من تاريخ إستلام البحث، و倮موعد النشر، ورقم العدد الذي سينشر فيه البحث.
- يحق للمجلة ملاحظات من المحكمين ترسل الملاحظات إلى الباحث لإجراء التعديلات اللازمة، على أن تعود خلال مدة أقصاها شهر.
- الأبحاث التي لم تتم الموافقة على نشرها لانعدام الالباحثين.
- تحتفظ المجلة بحقها في إخراج البحث وإبراز عناوينه بما يتناسب وأسلوبها في النشر.
- تلتزم المجلة بإرسال نسختين من العدد إلى صاحب البحث المنشور بعد طبع العدد.
- تؤول جميع حقوق النشر للمجلة.
- البحوث المنشورة تحت بهذه المجلة تعتبر عن آراء أصحابها ولا تعتبر عن رأي المجلة أو الجامعة.

مجلة الإنسان للعلوم الإنسانية والاجتماعية

تابع القواعد العامة وإجراءات النشر

العدد (5) المجلد (9) يناير 2016

- ISSN : 2410-7727
- ISSN : 2410-7735
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البحوث المنشورة في هذه المجلة تعبر عن آراء اصحابها ولا تعبر عن رأي المجلة أو الجامعة
Pattern of Congenital Heart Disease (CHD) Among Children Under Five Years Referred to Charitable Heart Foundation At Hadhramout Governorate, Yemen; 2010/2011

نمط امراض القلب الخلقية بين الأطفال تحت السنة الخامسة بالاستناد لمؤسسة القلب الخيرية-حضرموت-اليمن 2010/2011

Abdulla Saeed Al-Hanshi(1), Gamalat Mustafa Abd El-Ghany(1*) Ayman Obaid Zabal(2)

(1) Assistant Prof. Community Health Nursing, College of Nursing, Hadhramout University
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(2) B.sc. of Nursing graduates.
Pattern of Congenital Heart Disease (CHD) Among Children Under Five Years Referred to Charitable Heart Foundation At Hadhramout Governorate, Yemen; 2010/2011

Abstract:

**Background:** Congenital Heart Disease (CHD) is the most common congenital anomaly in newborns and it is a leading cause of death during the first year of life with a prevalence of 1% in live births. **Aim:** To determine the pattern of Congenital Heart Disease (CHD) among Children under Five Years according to the registry of Charitable Heart Foundation in Hadhramout, Yemen; 2010 ~ 2011. **Subject and method:** A descriptive retrospective design was used with purposive sampling. The study sample included 130 live birth children registered in charitable heart foundation in Hadhramout governorate were screened and investigated for CHD from September 2010 ~ Sep 2011. Two types of tools were used for data collection: a questionnaire sheet was designed for data collection from patient records in charitable heart foundation, the second tool that performed by telephone interview with parents of the patients to understand the demographic factors such as age, sex, type of CHD and association with endogamy between parent, and relation with presence of CHD in their child. **Result:** The results of the present study revealed that more than half of the studied sample (54.6%) was from the urban area and the prevalence of CHD among females was (50.8%) compared to (49.2%) among the males and VSD was the commonest lesion (30.8%) among the studied sample followed by ASD and PDA (15.4% and 14.6 %) respectively. The majority of children was affected by VSD, in the males (31.3%) compared to (30.1%) in the females. The endogamy between parent and relation with presence of disease were positive with (42.3%) of the study sample and negative with (57.7%) of them. **Recommendations:** Finding of this work highlight the need for increasing awareness of family and community in Hadhramout about CHD through health education programs which to provide them with information about CHD, types, early discover of the disease, and pre-marital counseling should be emphasized among susceptible families.

**Key Words:** Pattern, CHD, Charitable Heart Foundation, Hadhramout, Yemen.
الملخص:

الخلفية: أمراض القلب الخلقية من الأكثر الشروheiten الخلقية شيوعاً بين الأطفال، وهي من الأسباب الرئيسية للوفيات خلال السنوات الأولى من العمر ومعدل انتشار وصل الى 1% لكل لاجئ. وقد هدفت هذه الدراسة لتحديد نمط أمراض القلب الخلقية حسب سجلات مؤسسة أمراض القلب، حضرموت - اليمن خلال 2010 - 2011.


النتائج: ظهرت نتائج هذه الدراسة أن الأكثر من نصف العينة (54.6%) من المصابين من المدينة ومعدل الإصابة بين الإناث (50.8%) مقارنة (49.2%) بين الذكور وقد وجد أن الفتحة بين البطينين هو الأكثر انتشاراً (60.8%) بين العينات تحت البحث بليها الفتحة بين الأطفال ثم القناع الشرياني السالحة (15.4% و 14.6%) بالتساوي. الأطفال المصابين بالفتحة بين البطينيين كانوا من الذكور (31.2%) ومقارنة بين الإناث (30.1%) بين الأطفال. وقد وجدت هذه الدراسة أن الزواج بين الأقارب بين الوالدين وعلاقة الحالات المرضية الحالية ايجابية بين (32.6%) من العينة بينما كانت سلبية بين (57.5%).

التوصيات: بناءً على نتائج الدراسة نوصي بتسليط الضوء ورفع الوعي حول أمراض القلب الخلقية بين الأطفال في حضرموت من خلال برامج التثقيف الصحي ورفع الوعي حول انواع، وأهمية اكتشاف أمراض القلب الخلقية مبكراً وأهمية المشورة قبل الزواج خاصة لدى العائلات الذين لديهم استعدادات للمرض.

الكلمات المفتاحية: نمط أمراض القلب الخلقية، مؤسسة أمراض القلب الخيرية، حضرموت - اليمن.
Introduction:

Congenital Heart Disease (CHD) is the most common congenital anomaly in newborns and it is a leading cause of death during the first year of life with a prevalence of 1% in live births.[1]

Congenital Heart Diseases (CHDs) are the conformation abnormalities of the heart or the blood vessels, formed during fetal life (3 to 6 weeks of pregnancy), i.e. when the heart or the major blood vessels of the heart cannot develop properly before birth. The abnormalities involving the arteries, the valves, the coronary and the major vessels of the heart can be either simple or complex.[2]

Congenital heart diseases (CHDs) are relatively common with a prevalence ranging from 3.7 to 17.5 per 1000 live births [1, 3]. In the United States about 40,000 infants are born with heart defects each year.[4]

Etiology of congenital heart disease (CHD) is multi factorial & a large collection of environmental and genetic causes have a role in its pathogenesis.[3]

Several previous reports suggest a changing pattern and incidence of congenital heart disease in various geographic locations [5, 6] according to racial and ethnic factors.[7, 8] Knowledge of the epidemiology of congenital heart disease is the basis on which investigative efforts will emerge to identify the causes of cardiac dimorph genesis and afford opportunities to prevent them.[9]

Malformations of the cardiovascular system are also associated with significant medical morbidity, which requires use of costly medical facilities.[7] Thus, determining the prevalence and pattern of CHD is necessary to recommend valuable changes in health policies.[10] There is no information about the prevalence rate of Congenital Heart Disease (CHD) at Hadhramout governorate in Yemen therefore the objective of this study was to determine the pattern of Congenital Heart Disease (CHD) among Children under Five Years according to the registry of Charitable Heart Foundation in Hadhramout.
Subjects And Methods:

Research design: A descriptive retrospective design was used with purposive sampling.

Setting: This study was conducted at Charitable Heart Foundation in Hadhramout Governorate, Yemen.

Sampling: The study sample included 130 live birth children under five years registered in Charitable Heart Foundation in Hadhramout were screened and investigated for Congenital Heart Disease (CHD) from September 2010 ~ Sep 2011.

Tools Of Data Collection:

Two types of tools were used for data collection: A questionnaire sheet was designed for data collection from patient records in Charitable Heart Foundation, the second tool that performed by telephone interview with parents of the patients to understand the demographic factors such as age, sex, type of Congenital Heart Disease (CHD) and association with endogamy between parent, and relation with presence of the disease in their child.

Administrative design:

The director of Charitable Heart Foundation was previously informed and authors get written permission to do research, because of an ethical board to institution.

Statistical Analysis:

For statistical analysis the SPSS 14.0 statistical package is used. From statistical parameters the following is used; frequency table with percentage.

Results:

The socio-demographic characteristics of the studied sample are summarized in table 1. It shows that the most affected age group (43.8%) was from birth to less than one year and the prevalence of Congenital Heart Disease (CHD) among females was (50.8%)
compared to (49.2%) among the males and more than half (54.6%) of the study sample coming from urban areas.

Table 2 displays the patterns of Congenital Heart Disease (CHD) among study sample according to the data registry in Charitable Heart Foundation. The table reveals that VSD was the commonest lesion (30.8%) among the study sample followed by ASD and PDA (15.4% and 14.6 %) respectively while, Complex CHD and TOF were found (13% and 8.5%) among the study sample.

Table 2 illustrated the pattern of Congenital Heart Disease (CHD) with endogamy between parents among the study sample. The table, shows that the endogamy between parent and relation with presence of CHD were positive with (42.3%) of the study sample and negative with (57.7%) of them. Also, the table reveals that VSD was positive endogamy between parents with (29.1%) of study sample compared to (32%) was negative endogamy, while ASD was positive endogamy with (12.7%) compared to (17.3%) was negative endogamy and PDA was present at the same percentage (14.5%) with positive and negative endogamy among the study sample. While, Complex CHD was positive endogamy with (14.5%) compared to (12%) was negative endogamy and TOF was positive endogamy with (7.3%) compared to (9.3%) was negative endogamy among the study sample.

Table 4 illustrated the pattern of Congenital Heart Disease (CHD) with sex (male & female) among the study sample. The table reveals that VSD was found (31.3%) among males compared to (30.3%) among female, while ASD was found (18.2%) among female compared to (12.5%) among male and PDA was found (18.2%) among female compared to (10.9%) among male but, the Complex CHD was found (14.1%) among male compared to (12.1%) female and TOF was found (9.4%) in male compared to (7.6%) female of the study sample.

Table 5 shows the pattern of Congenital Heart Disease (CHD) with residence (urban & rural) among the study sample. The table reveals that VSD was found (35.2%) in urban area compared to (25.4%) in rural area among study sample, while ASD was found
(15.5%) in urban area compared to (15.3%) in rural area and PDA was found (23.7%) in rural area compared to (7%) in urban area but, the Complex CHD was found (12.7%) in urban area compared to (13.6%) in rural area and TOF was found (11.3%) in urban area compared to (5.1%) in rural area among the study sample.

Table (1) Distribution of the study sample by their Socio-demographic characteristics according the data referred to Charitable Heart Foundation during 2010-2011

<table>
<thead>
<tr>
<th>Socio-demographic characteristics</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth  &lt; 1 Year</td>
<td>57</td>
<td>43.8</td>
</tr>
<tr>
<td>1 - &lt; 2 Y</td>
<td>31</td>
<td>23.8</td>
</tr>
<tr>
<td>2 - &lt; 3 Y</td>
<td>12</td>
<td>9.2</td>
</tr>
<tr>
<td>3 - &lt; 4 Y</td>
<td>5</td>
<td>3.8</td>
</tr>
<tr>
<td>4 - 5 Y</td>
<td>25</td>
<td>19.2</td>
</tr>
<tr>
<td>Sex:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>64</td>
<td>49.2</td>
</tr>
<tr>
<td>Female</td>
<td>66</td>
<td>50.8</td>
</tr>
<tr>
<td>Residence:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>71</td>
<td>54.6</td>
</tr>
<tr>
<td>Rural</td>
<td>59</td>
<td>45.4</td>
</tr>
<tr>
<td>Family history to CHD:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>9</td>
<td>6.9</td>
</tr>
<tr>
<td>Negative</td>
<td>121</td>
<td>93.1</td>
</tr>
<tr>
<td>Endogamy between parents:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>55</td>
<td>42.3</td>
</tr>
<tr>
<td>Negative</td>
<td>75</td>
<td>57.7</td>
</tr>
</tbody>
</table>

**CHD: Congenital Heart Disease**

Table (2) Patterns of Congenital heart disease (CHD) among the study sample according to the data registry in Charitable Heart Foundation during 2010-2011

<table>
<thead>
<tr>
<th>Pattern of CHD according the diagnosis</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDA</td>
<td>19</td>
<td>14.6</td>
</tr>
<tr>
<td>ASD</td>
<td>20</td>
<td>15.4</td>
</tr>
<tr>
<td>VSD</td>
<td>40</td>
<td>30.8</td>
</tr>
<tr>
<td>TOF</td>
<td>11</td>
<td>8.5</td>
</tr>
</tbody>
</table>
Complex CHD (CCHD) 17 13
PDA- ASD-VSD 2 1.5
PDA - VSD 5 3.8
PDA - PS 2 1.5
ASD-VSD 5 3.8
VSD- PS 2 1.5
VSD- Complex CHD 1 0.8
Total 130 100


Table (3) Pattern distribution of Congenital Heart Disease (CHD) with endogamy between parents among the study sample referred to Charitable Heart Foundation

<table>
<thead>
<tr>
<th>Pattern of CHD according the diagnosis</th>
<th>Endogamy between parents</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive Frequency</td>
<td>%</td>
<td>Negative Frequency</td>
</tr>
<tr>
<td>PDA</td>
<td>8</td>
<td>14.5</td>
<td>11</td>
</tr>
<tr>
<td>ASD</td>
<td>7</td>
<td>12.7</td>
<td>13</td>
</tr>
<tr>
<td>VSD</td>
<td>16</td>
<td>29.1</td>
<td>24</td>
</tr>
<tr>
<td>TOF</td>
<td>4</td>
<td>7.3</td>
<td>7</td>
</tr>
<tr>
<td>PS</td>
<td>2</td>
<td>3.6</td>
<td>4</td>
</tr>
<tr>
<td>Complex CHD</td>
<td>8</td>
<td>14.5</td>
<td>9</td>
</tr>
<tr>
<td>PDA- ASD-VSD</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>PDA - VSD</td>
<td>3</td>
<td>5.5</td>
<td>2</td>
</tr>
<tr>
<td>PDA - PS</td>
<td>1</td>
<td>1.8</td>
<td>1</td>
</tr>
<tr>
<td>ASD-VSD</td>
<td>3</td>
<td>5.5</td>
<td>2</td>
</tr>
<tr>
<td>VSD- PS</td>
<td>2</td>
<td>3.6</td>
<td>0</td>
</tr>
<tr>
<td>VSD- Complex CHD</td>
<td>1</td>
<td>1.8</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100</td>
<td>75</td>
</tr>
</tbody>
</table>

Table (4) Pattern distribution of Congenital Heart Disease (CHD) with the sex of studied sample referred to Charitable Heart Foundation

<table>
<thead>
<tr>
<th>Pattern of CHD according the diagnosis</th>
<th>Male</th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
</tr>
<tr>
<td>PDA</td>
<td>7</td>
<td>10.9</td>
<td>12</td>
</tr>
<tr>
<td>ASD</td>
<td>8</td>
<td>12.5</td>
<td>12</td>
</tr>
<tr>
<td>VSD</td>
<td>20</td>
<td>31.3</td>
<td>20</td>
</tr>
<tr>
<td>TOF</td>
<td>6</td>
<td>9.4</td>
<td>5</td>
</tr>
<tr>
<td>PS</td>
<td>3</td>
<td>4.7</td>
<td>3</td>
</tr>
<tr>
<td>Complex CHD</td>
<td>9</td>
<td>14.1</td>
<td>8</td>
</tr>
<tr>
<td>PDA- ASD-VSD</td>
<td>1</td>
<td>1.6</td>
<td>1</td>
</tr>
<tr>
<td>PDA- VSD</td>
<td>3</td>
<td>4.7</td>
<td>2</td>
</tr>
<tr>
<td>PDA- PS</td>
<td>1</td>
<td>1.6</td>
<td>1</td>
</tr>
<tr>
<td>ASD-VSD</td>
<td>3</td>
<td>4.7</td>
<td>2</td>
</tr>
<tr>
<td>VSD- PS</td>
<td>2</td>
<td>3.1</td>
<td>0</td>
</tr>
<tr>
<td>VSD- Complex CHD</td>
<td>1</td>
<td>1.6</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>100</td>
<td>66</td>
</tr>
</tbody>
</table>


Table (5) Pattern distribution of Congenital Heart Disease (CHD) with the residence of studied sample referred to Charitable Heart Foundation

<table>
<thead>
<tr>
<th>Pattern of CHD According The Diagnosis</th>
<th>Urban Frequency</th>
<th>%</th>
<th>Rural Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDA</td>
<td>5</td>
<td>7</td>
<td>14</td>
<td>23.7</td>
</tr>
<tr>
<td>ASD</td>
<td>11</td>
<td>15.5</td>
<td>9</td>
<td>15.3</td>
</tr>
<tr>
<td>VSD</td>
<td>25</td>
<td>35.2</td>
<td>15</td>
<td>25.4</td>
</tr>
<tr>
<td>TOF</td>
<td>8</td>
<td>11.3</td>
<td>3</td>
<td>5.1</td>
</tr>
<tr>
<td>PS</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Complex CHD</td>
<td>9</td>
<td>12.7</td>
<td>8</td>
<td>13.6</td>
</tr>
<tr>
<td>PDA- ASD-VSD</td>
<td>1</td>
<td>1.4</td>
<td>1</td>
<td>1.7</td>
</tr>
</tbody>
</table>
Discussion:

Congenital heart diseases are an important group of disease that cause great morbidity and mortality in children. Early recognition of such lesions has great implications on prognosis.

The present study revealed the most affected age group (43.8%) was from birth to less than one year and the prevalence of Congenital Heart Disease (CHD) among females was (50.8%) compared to (49.2%) among the males and more than half (54.6%) of the study sample coming from urban areas. This finding disagree with the study in Iran [11] who found that CHD was more common in male births and also, this finding is not similar to that reported in Saudi Arabia [12], and Iceland [13] where the frequency was the same for males and females while this finding in line with study in Nigeria [14] CHD was found to be more common in female births.

The current study revealed that VSD was the commonest lesion (30.8%) among the study sample followed by ASD and PDA (15.4% and 14.6 %) respectively while, Complex CHD and TOF were found (13% and 8.5%) among the study sample , these results agrees with the findings of the study formed by Sheikh et al., 2012 [15] who found that the most frequent type of congenital heart disease was found to be ventricular septal defect (VSD) (33.45%), followed by atrial septal defect (ASD) (13.6%), and patent ductus arteriosus (PDA) (10.6%). And also in line with Aburawi, 2006 [16] who mentioned that Worldwide ventricular septal defect (VSD) is the most common acyanotic CHD accounting 25-30% of all CHD.
This may be explained by the difference in genetic makeup & ethnicity. Atrial septal defect (ASD) ranked second in frequency accounting for 13.6% . Patent ductus arteriosus (PDA) was seen in 10% of cases.

The most frequent type of CHD was found to be ASD which is in accordance with another study in Iran [17] while in other studies [9, 18, 19, 20-13] the most frequent type of CHD was VSD. This could be due to the severity of defects which might have led to the death of patients before accessing the medical facilities. This might also be due to racial and genetic factors in different populations.

The finding of the present study showed that VSD was found among males (31.3%) compared to (30.3%) among female, while ASD was found (18.2%) among female compared to (12.5%) among male and PDA was found (18.2%) among female compared to (10.9%) among male. These results in line with Sheikh et al., 2012 [15] in the finding of the rate of VSD in males & females were 1.27:1. The rate of ASD in males was 1.17:1. And disagree of the result PDA was found to be more common in male than female. Parents of (6.25%) babies were related. None of the affected children had a positive family history of birth defects, hypertension, diabetes, thyroid disorder. History of still birth were found in 1% of mother – was Down syndrome. This finding agree with study by [21] (Khan et al., 2011) who reported that eight cases of the studied sample had a family history of CHD. The finding of this study revealed VSD was found (25.4%) in rural area among study sample, and PDA was found (23.7%) in rural area, these results disagree with study performed in rural area by [21] (Khan et al., 2011) who reported that Atrial septal defect was the commonest lesion with a prevalence of 9.6 per 1000 followed by ventricular septal defect with a prevalence of 5.8 per 1000 children.
Conclusion:

In the light with the main study findings, it might be concluded that the pattern of Congenital Heart Disease (CHD) among females was (50.8%) compared to (49.2%) among the males and the most affected age group (43.8%) was from birth to less than one year and 54.6% of the sample coming from urban areas. VSD was the commonest lesion (30.8%) among the study sample followed by ASD and PDA (15.4% and 14.6 %) respectively. The majority of children was affected by VSD, in the males (31.3%) compared to (30.3%) in the females. The endogamy between parent and relation with presence of disease were positive with (42.3%) of the study sample and negative with (57.7%) of them.

Acknowledgment:

This study was done in Charitable Heart Foundation at Hadhramout Governorate during the period of 2010-2011. We would like to thank all the personnel at Charitable Heart Foundation for their assistance in this study.
References:


21. Khan OS, Urmij SJ, Rahman M, and Almuzzaman; Screening of School Children for Operable Congenital Heart Diseases in Rural Area; University Heart Journal; Vol. 7, No. 1, January 2011.
Synthesis of Fe3O4 nanoparticles from Ferric Nitrate by Sol-Gel Method

تخليق جزيئات النانوية لأكسيد الحديد المغناطيسي "Fe3O4" من نترات الحديد بواسطة طريقة محلول - غروي

Nabil Abdullah Noman Alkadasi

- Hubei key lab of Materials Chemistry & Service Failure, School of Chemistry & Chemical Engineering, Huazghog University of Science and Technology, Wuhan, Hubei, 430074 China.
- Doctor - Department of Chemistry, Faculty of Education and Science, Rada'a, Al-Baida'a, University, Yemen.
Synthesis of Fe3O4 nanoparticles from Ferric Nitrate by Sol-Gel Method

Abstract:

Fe3O4 nanoparticles were synthesized from Ferric Nitrate by Sol-Gel method with annealing under vacuum. The phase structures, morphologies, particle sizes, chemical composition, and magnetic properties of Fe3O4 nanoparticles were characterized by TEM, U.V and XRD.

The results indicated that the size, the corresponding saturation magnetization value and coercivity value of Fe3O4 nanoparticles increase with the increase of temperature. Fe3O4 nanoparticles was studied under different atmospheres and temperatures.

Keywords: Ferric Nitrate, Fe3O4 nanoparticles, properties and characterization.
Introduction:

In the past decade, a variety of methods have been developed to form highly structure-controlled materials of functionalized metals, semiconductors and copolymer nanoparticles on the nano- or microscale. As a versatile kind of material, magnetite has attracted much attention in recent years.

Ferrite iron (Fe$_3$O$_4$) is a traditional magnetic material used in magnetic storage media, solar energy transformation, electronics, ferrofluids, biomedicine and catalysis [1-4]. During the last decade, significant research has been done in the field of nanosized magnetic particles, due to their potential for biomedical applications, such as improving the quality of Magnetic Resonance Imaging (MRI), and drug delivery systems [5–6].

Fe$_3$O$_4$ nanoparticles have been the subject of intense interest because of their potential applications in several advance technological areas due to their promising physical and chemical properties. Generally, these properties depend on the size and structure of particles. Fe$_3$O$_4$ nanoparticles find wide applications in the field of biomedical, as anticancer agent and corrosion protective pigments in paints and coatings [7-9]. The magnetic atoms or ions in such solid materials are arranged in a periodic lattice and their magnetic moments collectively interact through molecular exchange fields, which give rise to a long-range magnetic ordering.

Among all iron oxide nanoparticles, Fe$_3$O$_4$ represent the most interesting properties due to of its unique structure i.e. the presence of iron cations in two valence states, Fe$^{2+}$, Fe$^{3+}$ on tetrahedral and octahedral sites with an inverse cubic spinel structure. The coercivity and remenance values for the super paramagnetic nano Fe304 nanoparticles have been found to be zero by the earlier reported methods [10-13]. Presently, cell labelling strategies find application of superparamagnetic ferrite either through conjugating the magnetic nanoparticles to the cellular surface of the stem cell or by internalization of the particles into the cell. Superparamagnetic ferrite can work in both of these ways, since the potential to manipulate their surface chemistry is plentiful and their sizes along
with other attributes promote their successful uptake into cells. The superparamagnetic nano ferrites also interface well with MRI technology.

The use of superparamagnetic particles play a crucial role in the diagnostic imaging modality technique finds application in the study of stem cell [14-15].

In this paper Fe$_3$O$_4$ nanoparticles were synthesized by heating to 40$^\circ$C at 2 hours and at 80$^\circ$C for 2 hours to obtained Sol Gel followed by drying for 6 hours at 120 $^\circ$C and then annealing at 200$^\circ$C and 400$^\circ$C in oven under vacuum to obtain Fe$_3$O$_4$ powder.

**Experimental Materials:**

Ferric nitrate (Fe(NO$_3$)$_3$. 9 H$_2$O) and ethylene glycol (C2H6O2) of analytical grade were obtained from Sinopharm Chemical Reagent Co ,Ltd ,China. The reagents were used without further purification.

Physical parameters of Ferric nitrate ( Fe ( NO$_3$)$_3$. 9 H$_2$O ) and Glycol (C2H6O2) are reported in table 1 and 2 respectively.

**Table 1. General Characteristics of** Ferric nitrate ( Fe ( NO$_3$)$_3$. 9 H$_2$O )

<table>
<thead>
<tr>
<th>Molecular formula</th>
<th>Ferric nitrate ( Fe ( NO$_3$)$_3$. 9 H$_2$O ) $\geq$ 98.5 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>White Powder</td>
</tr>
<tr>
<td>Molecular weight</td>
<td>404</td>
</tr>
<tr>
<td>Company</td>
<td>Sinopharm chemical reagent Co ,Ltd ,China</td>
</tr>
</tbody>
</table>

**Table 2. General Characteristics of** Ethylene Glycol (C2H6O2)

<table>
<thead>
<tr>
<th>Molecular formula</th>
<th>Ethylene Glycol (C2H6O2) $\geq$ 99 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>liquid</td>
</tr>
<tr>
<td>Molecular weight</td>
<td>62.07</td>
</tr>
<tr>
<td>density</td>
<td>1.111- 1.115</td>
</tr>
<tr>
<td>Company</td>
<td>Sinopharm chemical reagent Co ,Ltd ,China</td>
</tr>
</tbody>
</table>
Preparation of Magnetite Nanoparticles:

The procedure of synthesizing magnetite nanoparticles [16-19] is described as follows:

20.2 gram ferric nitrate was first dissolved in 25 mL ethylene glycol with vigorous stirring speed 500 r.p.m in 100 mL three necked flask glass with out cover for 2 hours at 40°C, and then the solution was heated to 80°C and kept at the temperature to obtain brown gel. The gel was obtained after 2 hours and then dried at 120°C for about 4 hours in petri dish. After drying, the xerogel was annealed at temperature range 200 and 400°C under vacuum. Finally, different size magnetite nanoparticles were obtained.

Transmission Electron Microscope (TEM) Test:

For TEM Test, a small amount of sample was dissolved in 3 mL of deionized water in test tube and the solution was stirred by ultra-sonication. Then 10 μL sample was transferred to clean Copper Grid and kept for drying for TEM test. The TEM micrographs of samples were observed by CM 12 Philips Transmission Electron Microscope.

Results and Discussion:

Plate 1,2,3,4,5,6,7 and 8 (TEM) at 200°C and plate 9,10,11,12,13,14,15,16,17,18 and 19 (TEM) at 400°C shows the top-view TEM images of the Fe3O4 Nanoparticle plate (TEM) 1. The size of the Fe3O4 nanoparticle is clear from the TEM. The surface of Fe3O4 nanoparticle shows several large meandering wrinkles. The size of Fe3O4 nanoparticle can be clear from TEM image. Fig (1 and 2) X-ray diffraction shown the graph all of Magnetite and Fe3O4 nanoparticle. Fig (3 and 4) U.V shown the graph all of Magnetite and Fe3O4 nanoparticle respectively dispersed in chloroform.
References:


Plate1: Fe₃O₄ 200 °C  
Plate2: Fe₃O₄ 200 °C

Plate3: Fe₃O₄ 200 °C  
Plate4: Fe₃O₄ 200 °C
Synthesis of Fe3O4 nanoparticles from Ferric Nitrate by Sol-Gel Method
Nabil Abdullah Noman Alkadasi

Plate 5: Fe3O4  200 °C
Plate 6: Fe3O4  200 °C

Plate 7: Fe3O4  200 °C
Plate 8: Fe3O4  200 °C

Plate 9: Fe3O4  400 °C
Plate 10: Fe3O4  400 °C

Plate 11: Fe3O4  400 °C
Plate 12: Fe3O4  400 °C
Synthesis of Fe3O4 nanoparticles from Ferric Nitrate by Sol-Gel Method
Nabil Abdullah Noman Alkadi

Plate 13: Fe3O4  400 °C
Plate 14: Fe3O4  400 °C

Plate 15: Fe3O4  400 °C
Plate 16: Fe3O4  400 °C

Plate 17: Fe3O4  400 °C
Plate 18: Fe3O4  400 °C
Fig. 1: XRD for Fe$_3$O$_4$ Nanoparticle at 200 $^\circ$C

Fig. 2: XRD for Fe$_3$O$_4$ Nanoparticle at 400 $^\circ$C
Fig. 3: U.V of Fe$_3$O$_4$ $200^\circ$C

Fig. 4: U.V of Fe$_3$O$_4$ $400^\circ$C
Echocardiographic Patterns of Rheumatic Heart Disease. A study from A Specialized Heart Clinic

أنماط تخطيط صدى القلب لأمراض القلب الروماتيزمية
دراسة من عيادة القلب المتخصصة

Omar A. Baselm*,
Fahd N. Habtoor**,
Rifaat Salem Basuraih***

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* Faculty of Medicine & Health Sciences. Aden University
** Specialized Heart Clinic. Aden.
*** Faculty of Medicine & Health Sciences. Hadramout University.
Echocardiographic Patterns of Rheumatic Heart Disease. A study from A Specialized Heart Clinic

Abstract:

Background: Rheumatic heart disease (RHD) is an important contributor to cardiovascular disease in children and adults in Yemen. Rheumatic heart disease (RHD) continues to cause gross distortions of the heart and the associated complications of heart failure and thromboembolic phenomena in this age. Different valvular damages can cause real health problems for the affected persons by the disease.

Aims: To describe the presenting features of Rheumatic Heart Disease patients attended specialized heart clinic.

Methods: Echocardiographic data of patients attended this specialized clinic during the period of 3 years from January, 2009 to December, 2012 were analyzed. Two hundred and five patients who satisfied the inclusion criteria for RHD were found.

Results: Of the total 205 patients with RHD females were found to be more common than males (63.4%, vs. 36.6%). The study shows that RHD was found more common in the age group 20-30 years. According to the valve lesions mitral valve is mostly affected (65.4%), followed by mixed valve lesions (22.9%). Mitral stenosis was found to be more common (47.8%).

Conclusion: A significant proportion of RHD patients present to hospital with severe disease associated with severe complications of advanced heart failure, pulmonary hypertension, infective endocarditis and atrial fibrillation. Valve replacement done for some patients. There is a need to improve awareness of the disease among the population, and clinical suspicion in primary health workers, so that early referral to specialist management can be done before severe damage to the heart ensues.

Key words: Rheumatic Heart Disease. Echocardiography.
الملخص:

تعد أمراض القلب الروماتزيمية (RHD) من أهم الأسباب المؤدية إلى إصابة الأطفال والكبار بأمراض القلب والأوعية الدموية في اليمن. لا يزال يتسبب في تشوهات جسيمة في القلب، ومضاعفات مصاحبة كفشل القلب، وانسداد الأوعية الدموية. إن آثار الصممات المختلفة قد تسبب مشاكل صحية خطيرة للأشخاص المعرضين لها.

هدف الدراسة: تهدف الدراسة لوصف العلامات والملامح الظاهرة للمرضى المصابين بأمراض القلب الروماتزيمية المتعددة لعيادة القلب المختصة.

منهجية البحث: تم استئجار بيانات الرسم الصدوي القلب للمرضى المتورمين للعيادة المختصة بالقلب خلال فترة سنتين من يناير 2009 إلى ديسمبر 2012. وتم تحليلها، ثم العثور على مالتين وخمسة مرضى استوفوا معايير التشخيص لمرض القلب الروماتزيمي.

نتائج البحث: تم العثور على مالتين وخمسة مرضى استوفوا معايير التشخيص لمرض القلب الروماتزيمي.

الاستنتاج: إن نسبة كبيرة من المرضى المصابين بالمرض شديدة المتورمين إلى المستشفى وهم يعانون من أمراض شديدة مرتبطة بمضاعفات شديدة كفشل القلب المتقدم وارتفاع ضغط الدم الرئوي، والتهاب شغاف القلب الرجفان الأذيني، وتم استبدال صمام لبعض هؤلاء المرضى. وهنا كشفة إلى تحسين الوعي لهذا المرض بين السكان ينبغي الإحتالة المبكرة إلى عيادة مختصة يمكن أن يفيد المريض قبل حدوث أضرار فادحة في القلب.
Introduction:

Rheumatic Heart Disease is a condition when permanent damage of the heart valves occur as a result of previous rheumatic fever. The heart valves are damaged by disease process that generally begins with a strep throat caused by streptococcus A bacteria of beta hemolytic group, which may cause rheumatic fever. Rheumatic fever is an inflammatory disease, can affect many connective tissues, especially in the heart, joints, skin or the brain. As many as 39% of patients with acute rheumatic fever may develop varying degrees of pancarditis with associated valve insufficiency, heart failure, pericarditis and even death.

A study from Malawy reported that out of the 3908 new Malawian patients included in the 5-y period register, 34% had valvular heart disease (mainly rheumatic heart disease – RHD), that reflects its high magnitude. In another study from Nigeria, five hundred and fifty eight (19.8%) of the 2875 medical admissions were patients with cardiovascular disease. And out these 6% where RHD patients.

In a world health trial, a total of 1,433,710 school children were screened and 3135 cases of rheumatic fever/rheumatic heart disease were found, giving a prevalence of 2.2 per 1000 (higher in the African and Eastern Mediterranean regions). Rheumatic Heart Disease remains one of the most prevalent diseases is Yemen. In a study done among school-children in Aden, the prevalence of RHD was 36.5/1000 school-children, which is one of the highest reported among school echocardiography surveys in the world. Females are more prone to rheumatic heart disease than males. Socioeconomic status has a direct impact on the occurrence of rheumatic heart disease.

Rheumatic heart disease remains one of the main health problems in Yemen. It is probably the most common CVD diseases among children and young adults.
Present study was designed to determine the frequency of rheumatic heart disease in a specialized heart clinic in Aden, Yemen.

Methods:

This study was done in a specialized heart clinic in Aden city. Patients enrolled in the study are coming from different governorates of the southern part Yemen. All clinically suspected cases of RHD underwent Transthoracic Echocardiography examination was performed using color Doppler echo machine, with the different modalities for the B-mode, M-mode, and the Doppler studies for determination of valvular regurgitation, valvular stenosis, assessment of the severity of these pathologic findings. All the investigations were done in accordance to the criteria of World Heart Federation for the diagnosis of rheumatic heart disease.

Echocardiography was used as a tool for diagnosis of different types of valvular lesions with the assessment of severity of the valve damage. It gives more accurate estimation for the severity of stenosis or regurgitation, and for the quantification of the degree of pulmonary hypertension.

The collected data was downloaded to the computer for analysis. Patients were grouped to 4 groups (according to their ages). Patients with complications like atrial fibrillation were noted in their records and those who had done valve replacement also were recorded. Because of small number of the study cases, these were not grouped isolately.

Statistical analysis done using the Excel simple package. Age groups were expressed by percentages and averages (mean+standard deviation).

Results:

The total number of patients was 205. These were grouped into four groups according the ages (Group I from 10 to 20 years, Group II from 21 to 30y, Group III from 31 to 40 y, Group >40y.). The age group II represents the most affected group by RHD.
(40.98%), followed by group III (31.7%). The younger age group and those above 40 years were less affected & found to be with similar prevalence (13.17% & 14.15% respectively).

**Table 1: Distribution of RHD cases according to age**

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>10–20</th>
<th>21–30</th>
<th>31–40</th>
<th>40</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of cases</td>
<td>27</td>
<td>84</td>
<td>65</td>
<td>29</td>
<td>205</td>
</tr>
<tr>
<td>%</td>
<td>13.17%</td>
<td>40.98%</td>
<td>31.71%</td>
<td>14.15%</td>
<td>10%</td>
</tr>
</tbody>
</table>

In relation to the sex distribution of the RHD in our patients, we found that female patients are more prone to develop the disease 63% vs 37%.

To look for valve involvement we found that the prevalence of mitral valve disease is more prominent than other valves affected – 65.37% for mitral valve disease, followed by mixed valve affection 22.93% and the least affection was for aortic valve (11.27%).

**Table 2: Distribution of RHD cases according to valve type**

<table>
<thead>
<tr>
<th>Valvular lesion</th>
<th>Mitral valve</th>
<th>Aortic valve</th>
<th>Mixed valve</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of cases</td>
<td>134</td>
<td>24</td>
<td>47</td>
<td>205</td>
</tr>
<tr>
<td>%</td>
<td>65.37%</td>
<td>11.71%</td>
<td>22.73%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3: show the distribution of the cases in relation to mitral valve lesions. Mitral stenosis was found to be more common than other forms. 64 cases (47.8%) were found to have isolated mitral stenosis. Followed by mitral regurge which accounts for 31.3%. Mixed mitral disease was observed in 28 cases, which comprises 20.9%.

**Table 3: Distribution of RHD cases in relation to Mitral Valve Lesion**

<table>
<thead>
<tr>
<th>Valvular lesions</th>
<th>Mitral Stenosis</th>
<th>Mitral Regurge</th>
<th>Mixed Mitral Disease</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Cases</td>
<td>64</td>
<td>42</td>
<td>28</td>
<td>134</td>
</tr>
<tr>
<td>%</td>
<td>47.76%</td>
<td>31.34%</td>
<td>20.90%</td>
<td>100%</td>
</tr>
</tbody>
</table>
As seen in table 4 which demonstrates different forms of aortic valve affection in this study. As it is seen the total number of patients with aortic valve lesions were only 24 patients. Aortic regurge comprises 17 cases (70.83%) and cases with aortic stenosis were discovered in 7 patients (29.17%).

Table 4: Distribution of RHD cases regarding Aortic Valve Lesion

<table>
<thead>
<tr>
<th>Valvular lesions</th>
<th>Aortic stenosis</th>
<th>Aortic regurg.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of cases</td>
<td>7</td>
<td>17</td>
<td>24</td>
</tr>
<tr>
<td>%</td>
<td>29.17%</td>
<td>70.83%</td>
<td>100%</td>
</tr>
</tbody>
</table>

As seen in table 5 Frequency distribution of specific valvular lesions, of the total number of echocardiography records of our patients with RHD demonstrates, that mitral stenosis (MS) is most common type of the rheumatic valvular disease. It was detected in 64 cases (31.22%). Combined valve disease (Mitral + Aortic) was found in 47 cases, which comprises 22.93%, followed by mitral regurge (MR) 42 cases (20.49%).

Table 5: Distribution of RHD cases according to Specific Valvular Lesion

<table>
<thead>
<tr>
<th>Valve lesions</th>
<th>MS</th>
<th>MR</th>
<th>Mixed MD</th>
<th>Combined valve D</th>
<th>AS</th>
<th>AR</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>64</td>
<td>42</td>
<td>28</td>
<td>47</td>
<td>7</td>
<td>17</td>
<td>205</td>
</tr>
<tr>
<td>%</td>
<td>31.22%</td>
<td>20.49%</td>
<td>13.66%</td>
<td>22.93%</td>
<td>3.41%</td>
<td>8.29%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 6 shows that 78 cases (38%) of our patients had undergone intervention whether Balloon Valvotomy (BMVT), or others of them underwent open heart surgery. Of the 78 cases 34 cases (16.95%) had underwent Mitral valve replacement by metallic valve (MVR). 25 patients (12.20%) had been operated for double valve replacement (DVR). Balloon valvotomy was performed for 12 patients (5.85%). Aortic valve replacement was found only in 7 cases (3.41%).
Table 6: Distribution of RHD cases according to the type of Surgical intervention

<table>
<thead>
<tr>
<th>Non Operated</th>
<th>BMVT</th>
<th>MVR</th>
<th>AVR</th>
<th>DVR</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of Cases</td>
<td>127</td>
<td>12</td>
<td>34</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>%</td>
<td>61.95%</td>
<td>5.85%</td>
<td>16.95%</td>
<td>3.41%</td>
<td>12.20%</td>
</tr>
</tbody>
</table>

Table 7 shows the distribution of the patients with RHD according to their area of residency. Majority of our patients came from Aden governorate 72 cases (35.12%). Patients from Abyan governorate takes the second place – 63 (30.73%). Where patients from Lahej governorate comprises 16.10% of the total number. Other governorates of southern parts of Yemen show less figures.

Table 7: Distribution of RHD cases according to Residency

<table>
<thead>
<tr>
<th>Residency</th>
<th>Aden</th>
<th>Abyan</th>
<th>Lahej</th>
<th>Aldhalae</th>
<th>Shabwa</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>72</td>
<td>63</td>
<td>33</td>
<td>11</td>
<td>16</td>
<td>10</td>
<td>205</td>
</tr>
<tr>
<td>%</td>
<td>35.12%</td>
<td>30.73%</td>
<td>16.10%</td>
<td>5.37%</td>
<td>7.8%</td>
<td>4.88%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion:

Several studies had been about RHD in Yemen, whether hospital based data, or screening among school children⁵,¹²,¹³. To our knowledge this the first study from a private specialized heart clinic.

Rheumatic heart is still a prevailing disease among Yemeni population and it is surprisingly having higher prevalence among school children.

Our results show that rheumatic heart disease affecting females than males (63.4% vs 36.6%), which is coincident with the findings of Essien IO¹³ in the study done at Enugu, Nigeria, with Hamzullah Khan from Pakistan¹⁴. And it in contrast to the study done by H.K.Saleh¹² which showed almost equal frequency among both male & female. Our study show that mitral valve affection is the most common than other valves (65.37%) from the total number of studied group, which correlates with other studies⁵,¹⁴. We found that mitral stenosis is more common than mitral regurge  which in
contradiction with other studies done by H.K. Saleh, may because our study included only adult patients. While those studies including children are more prevalent mitral regurgure or equal in frequency. Some of the patients were found to be in advanced stage of rheumatic heart disease. And these patients had underwent surgical correction of the valves or done for them transcatheter balloon valvotomy (38% of the cases). Of the studied group 12 patients had done BMVT 2 of them during pregnancy. 34 cases underwent MVR.

Although nowadays some of these patients could get surgical correction, but still the problem of rheumatic heart disease is a great burden for Yemeni health situation. Further actions should be done among the children and young adult population to eradicate the cause of rheumatic fever, which consequently leads to rheumatic valvular disease.

References:


Echocardiographic Patterns of Rheumatic Heart Disease: A study from A Specialized Heart Clinic
Omar A. Baselm, Fahd N. Habtoor, Rifaat Salem Basraiah
Pattern Of Heart Disease In Socotra Island

أنماط أمراض القلب في جزيرة سقطرى

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المجلد (3)

يناير 2015

ISSN : 2410-7727

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Pattern of Heart Disease in Socotra Island

Abstract:

Socotra is a small archipelago in Yemen located in Indian Ocean and consists of the main island of Socotra and three smaller islands. The healthy service in this island is rare and there is lack of medical facilities in this island. There is no studies were done regarding the pattern of heart disease in this island, so the aim of this study to highlight the cardiovascular problem among SOCOTRIAN people and show its pattern which reflects the magnitude of problem.

Aim: The aim of our study is to estimate the pattern of heart disease in Socotra Island.

Methods: During March 2013 while outreach program which is organized by non-governmental organizations which was held in Khalifa Bin Zayed Al Nahyan hospital – Hadibu district (the capital of the island), 123 patients were consulting and subjected to clinical examination and suspected cases were referred to ECG and echocardiography beside the routine laboratory and chest X-ray. The data collected and subjected to statistical analysis and main abnormality was left ventricular hypertrophy. 6 patients were diagnosed as congenital heart disease mainly non cyanotic. 9 patients had rheumatic heart disease mainly double valve disease. 14 patients were found to have arterial hypertension, and 11 patients needs cardiac intervention (coronary angiography, valve replacement, percutaneous mitral and pulmonary valvuloplasty).

Recommendations: Cardiovascular disease represents a big problem in SOCOTRA Island. Rheumatic heart disease and arterial hypertension was more common cardiovascular disease and health and health organizations with ministry of health should interfere to tackle this health problem either by preventive or curative program.

Keyword: rheumatic heart disease, Socotra Island, arterial hypertension.
الملخص:

سقطرى محافظة بنيانة، وهي عبارة عن أرخبيل يقع في المحيط الهندي، ويكون من سقطرى الجزيرة الرئيسة وثلاث جزر أخرى. الخدمة الصحية في هذه الجزيرة هي نادرة، وهناك نقص في المراقبة الطبية. لا توجد هناك أي دراسات حول نمط الإصابة بأمراض القلب في هذه الجزيرة.

الهدف: الهدف من دراستنا هو تقدير نمط الإصابة بأمراض القلب في جزيرة سقطرى.

منهجية البحث: خلال مارس 2012 بينما برنامج أيادي الخبر التي تنظمه المنظمات غير الحكومية الذي عقد في مستشفى خليفة بن زايد آل نهيان - منطقة حديبو (عاصمة الجزيرة)، تم معاناة مائة وثلاثة وعشرين (132) مريضًا، وخضعوا للفحص السريري وتمت إخلاء الحالات المشتبه منهم لعمل تحطيم للقلب وعمل الرسم الصدوي للقلب، إلى جانب الفحص المخبري الرتيني والأشعة السينية للصدر. البيانات التي تم جمعها تم تحليلها إحصائيًا. أظهرت الدراسة أن معظم المرضى يعانون من تضخم البطين الأيسر. وتم تشخيص ستة (6) مرضى يعانون من أمراض القلب الخلقي خاصة العيون غير الصاحبة بالإ_usecاق. وتسعة (9) من المرضى يعانون من الإصابة بأمراض القلب الروماتيزمية وخاصة آفة الصمامات المختلطة. وتم تشخيص أربعة عشرة (14) مريضًا لديهم ارتفاع ضغط الدم الشرياني، وأحد عشر (11) مريضًا يحتاجون لتدخل علاجي للقلب.

الوصيات: تمثل أمراض القلب والأوعية الدموية مشكلة كبيرة في جزيرة سقطرى. وأمراض القلب الروماتيزمية وأمراض القلب الشرياني وارتفاع ضغط الدم الشرياني أكثر شيوعًا، والمنظمات الصحية مع وزارة الصحة يجب أن تتدخل في التدخل في مواجهة هذه المشكلة الصحية إما عن طريق الوقاية أو برنامج علاجي.
Introduction:

Socotra, also spelled Soqotra, is a small archipelago. The archipelago in Indian Ocean and consists of the main island of Socotra (3,665 km²), the three smaller islands of Abd Al Kuri, Samhah and Darsa and small rock outcrops like Ka’l Fir'awn and Sābūnīyah that are uninhabitable by humans but important for seabirds (1). It lies some 240 kilometres east of the Horn of Africa and 380 kilometres south of the Arabian Peninsula (2). The island measures 132 kilometres in length and 49.7 kilometres in width. (3)

Almost all inhabitants of Socotra, numbering nearly 50,000, live on the homonymous main island of the archipelago. The archipelago forms two districts of the Hadhramout Governorate:

- the district of Hadibu, with a population of 32,285 and a district seat at Hadibu, consists of the eastern two-thirds of the main island of Socotra;
- The district of Qulansiyyah wa 'Abd-al-Kuri, with a population of 10,557 and a district seat at Qulansiyah, consists of the minor islands (the island of 'Abd-al-Kūrī chief among them) and the western third of the main island. (4)

The health service in SOCOTRA is very basic. The island is so isolated from the mainland that the cost if even the most basic daily food requirement is exorbitant; the health system is poor and consequently there are high rates of morbidity and mortality.

The first public clinic on SOCOTRA was built in the 1950s with the British help. By 2009, the health infrastructure consisted of one district general hospital in Hadibo, the capital town of Socotra; one health centre in Qalansiys district; and around 15 primary health units all over the island more than half were non functioning as well as some private clinic and pharmacies.

Regarding the health problems in Socotra, there were no available statistic, but research was done focusing on health
problems in 2009 reveals main problems are in respiratory and gastro-intestinal but no data regarding cardiovascular diseases in Socotra.

The aim of our study is to estimate the pattern of heart disease in Socotra Island.

Patients and Methods:

During march 2013 in Khalifa Bin Zayed Al Nahyan hospital – Hadibu district (the capital of the island), The Hospital built with funding from Khalifa bin Zayed Al Nahyan Humanitarian Foundation. 123 patients were screened by team consist of 6 cardiologist, 2 of them are specialist in pediatric cardiology in out patient clinic. Each patient was subjected to careful full history taken, detect risk factors for ischemic heart disease, all medications taken and any intervention was done to the patient followed by complete clinical examination stressing on cardiac auscultation, lower limb, head and neck and chest examination with blood pressure measurement. 12 leads standard electrocardiogram (ECG) was done to most of patients.

For the first time of the history of the island an echocardiography machine was introduced and echocardiography was requested according to the clinical condition of the patient for diagnosis of heart disease or follow up.

All these data were collected in questionnaire prepared, coded, revised and entered into personal computer and analyzed using SPSS program version 10.

Results:

One hundred and twenty three patients screened for presence or absence of cardiovascular disease, 62 of them were male (50.4%), and 61 (49.6%) were female with age range from 5-80 years with mean age 38.27 ± 17.77. 26 patients (21.1%) were hypertensive, 4 patients (3.3%) were known cases of diabetes mellitus under treatment and 3 patients were smokers (2.4%) as shown in table 1.
Regarding complains of patients (table 2); 47 patients (38.2%) were complaining of shortness of breath, while 17 patients (13.8%) complain of palpitation and 16 patients (13%) complain of chest pain. Major of patients 25 of them (20.3%) had non specific complain (multiple complain) while 17 patients (14.7%) had other complains (abdominal pain, chest tightness, Dizziness, general weakness, and headache).

ECG was done to 114 patients, 42 patients (34.1%) had abnormal ECG in form of left ventricle hypertrophy, ischemic heart disease, tall R in V1 and bundle branch block.

Echocardiography was done to 60 patients and the results as follows (table 3): 19 of them (15.4%) were normal echocardiography, 6 patients (4.8%) had congenital heart disease, and 9 patients (7.2%) had rheumatic heart disease, 5 patients (4%) with diagnosis of ischemic heart disease, while 14 patients (11.3%) had hypertensive heart disease by echo. The age of patients proved with diagnosis of rheumatic heart disease by echocardiography range between 7 to 40 years.

Eleven patients need intervention as follows: 4 patients needs diagnostic coronary angiography, 2 patients need mitral valve replacement, one patient need double valve replacement, 2 patients needs percutaneous pulmonary valvuloplasty, while one patient need percutaneous mitral valvuloplasty and one patient need closed follow up and trans-esophageal echo.

Table (1): basic criteria of patients

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>62 /123 (50.4%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td></td>
<td>61 /123 (49.6%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td>26 /123 (21.1%)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td></td>
<td>4/123 (3.3%)</td>
</tr>
<tr>
<td>Smoker</td>
<td></td>
<td>3/123 (2.4%)</td>
</tr>
</tbody>
</table>
Table (2): distribution of patients and percentage according to complain

<table>
<thead>
<tr>
<th>Complain</th>
<th>Number of patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortness of breath</td>
<td>47</td>
<td>38.2%</td>
</tr>
<tr>
<td>Chest pain</td>
<td>16</td>
<td>13%</td>
</tr>
<tr>
<td>Palpitation</td>
<td>17</td>
<td>13.8%</td>
</tr>
<tr>
<td>Non specific</td>
<td>25</td>
<td>20.3%</td>
</tr>
<tr>
<td>Dizziness</td>
<td>5</td>
<td>4.1%</td>
</tr>
<tr>
<td>Follow up</td>
<td>6</td>
<td>4.9%</td>
</tr>
<tr>
<td>Headache</td>
<td>2</td>
<td>1.6%</td>
</tr>
<tr>
<td>Chest tightness</td>
<td>1</td>
<td>0.8%</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>1</td>
<td>0.8%</td>
</tr>
<tr>
<td>Limb weakness</td>
<td>1</td>
<td>0.8%</td>
</tr>
<tr>
<td>Heart burn</td>
<td>1</td>
<td>0.8%</td>
</tr>
<tr>
<td>General weakness</td>
<td>1</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

Table (3): numbers of patients and percentage diagnosed by echocardiography. CHD; congenital heart disease. IHD; ischemic heart disease

<table>
<thead>
<tr>
<th>Echo diagnosis</th>
<th>Number of patients (total 60)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHD</td>
<td>6</td>
<td>4.8%</td>
</tr>
<tr>
<td>Rheumatic heart disease</td>
<td>9</td>
<td>7.2%</td>
</tr>
<tr>
<td>Normal</td>
<td>19</td>
<td>15.4%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>14</td>
<td>11.3%</td>
</tr>
<tr>
<td>Pure Hypertension</td>
<td>10</td>
<td>8.1%</td>
</tr>
<tr>
<td>Hypertension + IHD</td>
<td>2</td>
<td>1.6%</td>
</tr>
<tr>
<td>Hypertension + valvular</td>
<td>2</td>
<td>1.6%</td>
</tr>
<tr>
<td>IHD</td>
<td>5</td>
<td>4%</td>
</tr>
<tr>
<td>Mitral valve prolapsed</td>
<td>2</td>
<td>1.6%</td>
</tr>
<tr>
<td>Diastolic Heart failure</td>
<td>2</td>
<td>1.6%</td>
</tr>
<tr>
<td>Systolic heart failure</td>
<td>1</td>
<td>0.8%</td>
</tr>
<tr>
<td>Valvular heart disease</td>
<td>2</td>
<td>1.6%</td>
</tr>
</tbody>
</table>
Discussion:

There was no studies done in Socotra regarding the prevalence of heart disease but we seen some patients who can afford to come to Mukalla (capital of Hadramout government) or to Sana`a, so this study is considered the first one regarding the pattern of cardiovascular disease in Socotra island.

Rheumatic fever (RF) is a febrile disease affecting connective tissue, particularly in the heart and joints, initiated by infection of the throat by group A beta-hemolytic streptococci. It often leads to RHD which is a crippling illness (5). A study by Carpentis et al estimated that up to 15.6 million people are affected by RHD worldwide (6). Each year, there are approximately 470,000 new cases diagnosed and 233,000 deaths attributed to RHD (7). Al. Munibari et al. studied 5000 school children in Sana`a schools during period between October 1997 to March 1998, they found the prevalence of rheumatic heart disease 3.6 per 1000 which was higher than that reported from neighboring countries (8). In our study, 9 patients of 120 patients were diagnosed by echocardiography to have rheumatic heart disease inspite of low number of sampling and we did not focus the school children as this age is common in rheumatic fever and rheumatic heart disease, as age of study by Al-Munibari between 5-18 years while in our study between 7-40 years.

Saleh H. studied pattern of RHD in Aden between January 1999 to December 2003, he found 805 patients had RHD, and the age of patients ranged between 4-70 years but 90% of patients were under 50 years of age (9).

Regarding prevalence of rheumatic heart disease in near countries, screening of 9904 Omani school children from different regions in Oman gave a prevalence rate of rheumatic heart disease of 8/10,000 with no significant difference by sex or level of education (10).

Congenital heart disease is a structural or functional abnormality of heart or great vessels that is present at birth (11, 12). The
incidence of congenital heart disease reported in different countries is about 9/1000 (13), and the officinal census data in southern Yemeni governorates reports 27,200 live births per year (14).

Nine hundred and eighty seven child referred for echocardiography assessment, during the period between January 2001 to December 2005 in Aden, Hussein K. Saleh found 393 of 987 patients was congenital heart disease and the age of patients was from birth to 15 years (15), while in our study; we detect 6 patients of 123 were congenital heart disease and age range between 5-25 years as 2 cases had congenital pulmonary stenosis.

There was high prevalence of hypertensive patients in the island 14 patients of 123; which needs further study to know the cause. Using data from the 2nd Gulf Registry of Acute Coronary Events (Gulf RACE-2) in 2008–09 which investigated the in-hospital complications and 1-year outcome of acute coronary syndrome (ACS) in patients with systemic hypertension from 6 Gulf countries. Of 7847 consecutive patients admitted with ACS, 3746 (47.7%) had hypertension. Hypertension was more prevalent in women, in Arabs than non-Arabs and in older age groups(16).

The major limitation of this study is short time stay in the island and small sample size of patients. We recommend a big survey to detect the accurate prevalence of heart disease in the island and general practional doctors, pediatrician, nutrional specialist must included to the team and survey included all districts of the island and school children. Health organization and ministry of health should interfere to tackle the cardiovascular disease in Socotra island either by preventive or curative programs

Acknowledgment :

Special thanks to Dr. Ahmed El –Ans Minister of health in Yemen for his support to the team of the study and Special thanks to Mr. Mohamad Bashieb, chairman of charitable Heart Foundation-Mukalla for his great support and supplying the study with the echocardiography machine. Also we thank student Awadh Yousr Muftah in 6th year medical student in college of medicine in
hadramout university for his study regarding health infrastructure and main health problems in Socotra.

References:

Generating Functions For Quadruple Hyper geometric Function

اشتقاق بعض من الدوال المولدة للدوال الفوق هندسية الرباعية

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Generating Functions For Quadruple Hypergeometric Functions

Abstract:

The aim of this paper is to derive some of Generating Functions for the quadruple Hypergeometric functions \((K_3, K_{10}, K_{13}, K_{16} \text{ and } K_{18})\). The results are derived with the help of Laplace integral. A number of Generating Functions of such other types of hypergeometric functions are also derived as special cases of our main results.

Key words: Quadruple hypergeometric functions, generatingfunctions, Laplace integral, hypergeometric functions.
1. Introduction:

The following are the definitions and the Laplace integral representations of the quadruple hypergeometric functions $K_i$ ($i=3, 10, 13, 16$ and $18$) [1; p, 78-83]:

$$K_3\left(a, a, a; b_1, b_1, b_2, b_2, c_1, c_2, x, y, z, t\right)$$

$$= \sum_{p, q, r, s=0}^{\infty} \frac{(a)_{p+q+r+s} (b_1)_{p+q} (b_2)_{r+s} x^p y^q z^r t^s}{(c_1)_{p+s} (c_2)_{q+r} p! q! r! s!} \tag{1.1}$$

$$= \frac{1}{\Gamma(b_1) \Gamma(b_2)} \int_0^{\infty} \int_0^{\infty} e^{-u-v} u^{b_1-1} v^{b_2-1} \Psi_2(a; c_1, c_2; xu + tv, yu + zv) du dv, \tag{1.2}$$

$$K_{10}(a, a, a, b, b, c_1, c_2; d_1, d_2, d_3, d_4, x, y, z, t)$$

$$= \sum_{m, n, p, q=0}^{\infty} \frac{(a)_{m+n+p+q} (b)_{m+n} (c_1)_{p} (c_2)_{q} x^m y^n z^p t^q}{(d_1)_{m} (d_2)_{n} (d_3)_{p} (d_4)_{q} m! n! p! q!} \tag{1.3}$$

$$= \frac{1}{\Gamma(a)} \int_0^{\infty} e^{-u} u^{a-1} \Psi_2(b; d_1, d_2; xu, yu), F_1(c_1, d_3; zu), F_1(c_2, d_4; tu) du \tag{1.4}$$

$$K_{13}(a, a, a, b_1, b_2, b_3, b_4; c, c, d_1, d_2, x, y, z, t)$$

$$= \sum_{m, n, p, q=0}^{\infty} \frac{(a)_{m+n+p+q} (b_1)_{m} (b_2)_{n} (b_3)_{p} (b_4)_{q} x^m y^n z^p t^q}{(c)_{m+n} (d_1)_{p} (d_2)_{q} m! n! p! q!} \tag{1.5}$$

$$= \frac{1}{\Gamma(a)} \int_0^{\infty} e^{-u} u^{a-1} \Phi_2(b_1, b_2; c, xu, yu), F_1(b_3, d_1; zu), F_1(b_4, d_2; tu) du \tag{1.6}$$

$$K_{16}(a_1, a_2, a_3, a_4; b; x, y, z, t)$$

$$= \sum_{m, n, p, q=0}^{\infty} \frac{(a_1)_{m+n} (a_2)_{m+p} (a_3)_{n+q} (a_4)_{p+q} x^m y^n z^p t^q}{(b)_{m+n+p+q} m! n! p! q!} \tag{1.7}$$

$$= \frac{1}{\Gamma(a_2) \Gamma(a_3)} \int_0^{\infty} \int_0^{\infty} e^{-u-v} u^{a_2-1} v^{a_3-1} \Phi_2(a_1, a_4; b; xu + yv, zu + tv) du dv$$
\[ (1.8) \quad K_{18} \left( a_1, a_2, a_3, b_1, b_2; c; x, y, z, t \right) = \sum_{m,n,p,q=0}^{\infty} \frac{(a_1)_{m+n} (a_2)_{m+q} (a_3)_{n+p} (b_1)^m (b_2)^p}{(c)_{m+n+p+q} m! n! p! q!} x^m y^n z^p t^q \] (1.9)

\[ = \frac{1}{\Gamma(a_1) \Gamma(b_1) \Gamma(b_2)} \int_0^\infty \int_0^\infty \int_0^\infty e^{-u-v-w} u^{a_1-1} v^{b_1-1} w^{b_2-1} \Phi_2(a_2, a_3; c; xu + tw, yu + zw) \, du \, dv \, dw \quad (1.10) \]

2. Generating functions

In this section we have established the following generating relations:

\[ \sum_{n=0}^{\infty} \frac{(b_1)_n (b_2)_n w^n}{n!} K_3 \quad (d)_n n! \quad (a, a, a, a; b_1 + n, b_2 + n, c_1, c_2, c_3; x, y, z, z) \]

\[ = F^{(3)} \left[ \begin{array}{c} \vdots \quad a_1, c_1 + c_2, -1 ; b_2, b_1 ; a_1, c_1 + c_2 - 1 ; 4x, 4y, w \end{array} \right] \quad (2.1) \]

\[ \sum_{n=0}^{\infty} \frac{(a)_n w^n}{n!} K_3 \left( a + n, a + n, a + n, a + n, b_1, b_2; c_1, c_2, c_3; x, y, y \right) \]

\[ = F^{(3)} \left[ \begin{array}{c} \vdots \quad \frac{1}{2} (c_1 + c_2), -1 ; b_2, b_1 \vdots \quad c_1 + c_2 - 1 ; 4x, 4y, w \end{array} \right] \quad (2.2) \]

\[ \sum_{n=0}^{\infty} \frac{(a_2)_n (a_3)_n w^n}{n!} K_{16} \left( a_1, a_2 + n, a_3 + n, b_1 - a_1 ; b_1; x, y, z, t \right) \]

\[ = (1 - z)^{-a_2} (1 - t)^{-a_1} F^{(3)} \left[ \begin{array}{c} \vdots \quad a_1 ; a_2 ; - ; - ; x - z, y - t \end{array} \right] \quad (2.3) \]

\[ \sum_{n=0}^{\infty} \frac{(a_2)_n (a_3)_n w^n}{(b_2)_n n!} K_{16} \left( a_1, a_2 + n, a_3 + n, b_1 - a_1 ; b_1; x, y, z, t \right) \]
\[
H_A \left[ a_3, a_2, a_1 ; b_1, b_2, b_1 ; \frac{w}{(1-z)(1-t)}, \frac{x-z}{1-z}, \frac{y-t}{1-t} \right] \] 
(2.4)

\[
\sum_{n=0}^{\infty} \frac{(a_1)_n (a_2)_n}{(b_1)_n n!} w^n K_{16} \left( a, a_1 + n, a_2 + n, a_3 ; b_1 + n ; x, y, x, y \right) = H_C \left[ a_1, a + a_3, a_2 ; b_1 ; x, y, w \right], \quad (2.5)
\]

\[
\sum_{n=0}^{\infty} \frac{(b_1)_n (b_2)_n}{n!} w^n \frac{n!}{(c_1)_n n!} K_{18} \left( a_1 + n, a_2, c_1 - a_2, b_1 + n, b_2 + n ; c_1 ; x, x, z, t \right)
= (1-x)^{-a_1} (1-z)^{-b_1} H_A \left[ b_1, b_2, a_2, c_1 ; \frac{w}{(1-x)(1-z)}, t, \frac{-z}{1-z} \right], \quad (2.6)
\]

\[
\sum_{n=0}^{\infty} \frac{(b_1)_n (b_2)_n}{(c_2)_n n!} w^n \frac{n!}{(c_1)_n n!} K_{18} \left( a_1 + n, a_2, c_1 - a_2, b_1 + n, b_2 + n ; c_1 + n ; x, x, z, t \right)
= (1-x)^{-a_1} (1-z)^{-b_1} H_C \left[ b_2, a_2, b_1 ; c_1 ; t, \frac{z}{z-1}, \frac{w}{(1-x)(1-z)} \right], \quad (2.7)
\]

\[
\sum_{n=0}^{\infty} \frac{(b_1)_n (b_2)_n}{(c_1)_n n!} w^n K_{18} \left( a_1 + n, a_2, c_1 - a_2, b_1 + n, b_2 + n ; c_1 + n ; x, x, z, t \right)
= (1-x)^{-a_1} (1-z)^{-b_1} H_A \left[ b_1, b_2, a_2, c_1 ; \frac{w}{(1-x)(1-z)}, t, \frac{-z}{1-z} \right], \quad (2.8)
\]

\[
\sum_{n=0}^{\infty} \frac{(a)_n (b)_n}{(c)_n n!} w^n K_{18} \left( a + n, a + n, a + n, a + n ; b_1, b_1, c_1, c_2 ; b_1, b_1, 2c_1, 2c_2 ; x, y, 2z, 2t \right)
= A^{-a} H_4 \left[ a, b ; b_1, c_1 + \frac{1}{2}, c_2 + \frac{1}{2}, c ; \frac{xy}{A^2}, \frac{z^2}{4A^2}, \frac{t^2}{4A^2}, \frac{w}{A} \right], \quad (2.9)
\]

\[
\sum_{n=0}^{\infty} \frac{(a/2)_n ((a+1)/2)_n}{(d)_n n!} w^n K_{18} \left( a + 2n, a + 2n, a + 2n, a + 2n ; b_1, b_1, c_1, c_2 ; b_1, b_1, 2c_1, 2c_2 ; x, y, 2z, 2t \right)
\]
\[
A^{-a} F_C^{(4)} \left[ \frac{a}{2}, \frac{a+1}{2}; b_1, c_1 + 1, c_2; 2b_1, 2c_1, 2c_2; 2x, 2y, 2z, 2t \right], (2.10)
\]

\[
\sum_{n=0}^{\infty} \frac{(a)_n(b)_n}{(c)_n n!} w^n K_{13} \left( a+n, a+n, a+n; b_1, b_1, c_1, c_2; 2b_1, 2b_1, 2c_1, 2c_2; 2x, 2y, 2z, 2t \right) = A^{-a} (3H_4^{(4)} [a, b; b_1, 1; c_1, 1; c_2, 1; 2b_1, 2b_1, 2c_1, 2c_2; 2x, 2y, 2z, 2t]) (2.11)
\]

and

\[
\sum_{n=0}^{\infty} \frac{(a/2)_n ((a+1)/2)_n w^n}{(d)_n n!} K_{13} \left( a+2n, a+2n, a+2n; b_1, b_1, c_1, c_2; 2b_1, 2b_1, 2c_1, 2c_2; 2x, 2y, 2z, 2t \right) = A^{-a} F_C^{(4)} \left[ \frac{a}{2}, \frac{a+1}{2}; b_1, 1; c_1, 1; c_2, 1; 2b_1, 2b_1, 2c_1, 2c_2; 2x, 2y, 2z, 2t \right]. (2.12)
\]

where \( F^{(3)} \) is the General Triple Hypergeometric Series [3; p.44], \( H_A \) and \( H_C \) are the Srivastava's triple series [3;p.43], \( F_C^{(4)} \) is the Lauricella's Function of four variables [3;p.33], \( (3H_4^{(4)}) \) is the Generalized Horn's Function [1;p.97] and \( A = (1-x-y-z-t) \).

3. Results Required

The following results will be required in our present investigations (c.f.[2] and [3] ) :

\[
\Psi_2 [a; c, c', x, x] = \phi_3 a, \frac{c+c'-1}{2}; c, c', c+c'-1; 4x \right] (3.1)
\]

\[
F_{p:0;0} q:0;0 \left[ (a_p); -; -; x, y \right] = p F_q \left[ (a_p); (b_q); x+y \right] (3.2)
\]

\[
\Psi_2 [a; a, a; x, y] = e^{xy} e^{xy} F_{p:0;0} q:0;0 \left[ -; a; x, y \right] (3.3)
\]

\[
\Phi_2 [a, b-a; b; x, y] = e^{y} e^{xy} F_{p:0;0} q:0;0 \left[ a; b; x-y \right] (3.4)
\]
\[ e^{-su}u^{-a-1} du = \frac{\Gamma(a)}{s^a} \quad (3.6) \]

\[ \int_0^\infty e^{-su}u^{-a-1} F_1(-;d_1; xu^2), F_1(-;d_2; yu^2) du = \frac{\Gamma(a)}{s^a} F_4\left[ a, a+1, \frac{4x}{s^2}, \frac{4y}{s^2}; d_1, d_2, \frac{4x}{s^2}, \frac{4y}{s^2} \right] (3.7) \]

\[ (\lambda)_{2n} = 2^{2n} \left( \frac{1}{2} \lambda \right)_n \left( \frac{1}{2} \lambda + \frac{1}{2} \right)_n, \quad n = 0, 1, 2, \ldots \quad (3.8) \]

where the Functions \( p \ F_q \) is the Generalized Hypergeometric Function, \( F_4 \) is Appell's Function, \( \Phi_2 \) and \( \Psi_2 \) are the confluent Hypergeometric Function of two variables and \( F_{p,q;k}^{m,n} \) the Kampé de Fériet Function of two variables (c.f.[4]).

4. Proof of the results:

To prove (2.1), we proceed as follows:

Let us denote the left hand side of (2.1) by I and using (1.2), we get

\[ I = \sum_{n=0}^{\infty} \frac{(b_1)_n (b_2)_n}{(d)_n n!} \frac{w^n}{n!} \]

\[ \frac{1}{\Gamma(b_1+n)\Gamma(b_2+n)} \int_0^\infty \int_0^\infty e^{-u-v} u^{b_1+n-1} v^{b_2+n-1} \Psi_2(a; c_1, c_2, xu + zv, xu + zv) du dv \]

Now, using (3.1) and (3.2), we get

\[ I = \sum_{n=0}^{\infty} \frac{(b_1)_n (b_2)_n}{(d)_n \Gamma(b_1+n)\Gamma(b_2+n)n!} \frac{w^n}{n!} \]

\[ \int_0^\infty \int_0^\infty e^{-u-v} u^{b_1+n-1} v^{b_2+n-1} F_{3:0;0}\left[ a, \frac{1}{2}(c_1 + c_2), \frac{1}{2}(c_1 + c_2 - 1) ; -; -; 4xu, 4yv \right] du dv \]
Expressing the Kampé de Fériet function as double series and using (3.6), we have

$$ I = \sum_{n=0}^{\infty} \frac{(b_1)_n (b_2)_n w^n}{(d)_n \Gamma(b_1 + n) \Gamma(b_2 + n)n!} $$

$$ \sum_{r=0}^{\infty} \sum_{s=0}^{\infty} \frac{(a r + \frac{1}{2} (c_1 + c_2)) (a r + s + \frac{1}{2} (c_1 + c_2 - 1)) (4s + 4r + 4) (4x)^r (4z)^s \Gamma(b_1 + n + r) \Gamma(b_2 + n + s)}{r! s! (c_1)_r (c_2)_s (c_1 + c_2 - 1)_r (c_1 + c_2 - 1)_s} $$

$$ I = F^{(3)}\left[ -a, \frac{1}{2} (c_1 + c_2), \frac{1}{2} (c_1 + c_2 - 1); b_2, b_1; -; -; -; 4x, 4z, w \right] $$

This completes the proof of (2.1), the proofs of (2.2)-(2.8) are similarly.

To prove (2.9), we proceed as follows:
Let us denote the left hand side of (2.9) by I, using (1.4),(3.3) and (3.5), we get

$$ I = \sum_{n=0}^{\infty} \frac{(a)_n (b)_n w^n}{(c)_n n! \Gamma(a + n)} $$

$$ \int_{0}^{\infty} e^{-(1-x-y-z-u)u} u^{a+n-1} \left[ F_1 (\ldots; b_1; xu^2) \right] F_1 (\ldots; c_1 + \frac{1}{2} z^2 u^2) \right] F_1 (\ldots; c_2 + \frac{1}{2} t^2 u^2) du $$

Now, expressing the first $F_1$ into power series and using (3.7), we get

$$ I = \sum_{n,m=0}^{\infty} \frac{(a)_n (b)_m w^n (xy)^m \Gamma(a + n + 2m)}{(c)_n (b)_m n! m! \Gamma(a + n) A^{a+n+2m}} $$

$$ F_4 \left[ \frac{a + n + 2m}{2}, \frac{a + n + 2m + 1}{2}; c_1 + \frac{1}{2}, c_2 + \frac{1}{2} \frac{z^2}{A^2}, \frac{t^2}{A^2} \right] $$

Expressing Appell’s Function $F_4$ as double series and using (3.8), we will get the right hand side of (2.9), which complete the proof of (2.9). The proofs of (2.10) - (2.12) are similarly.
5. Particular Cases:

In this section, we shall mention some interesting generating relations as particular cases of our main results.

In (2.1), if we put \(a = c_1 = c_2\), then we get

\[
\sum_{n=0}^{\infty} \frac{(b_n)_n(a_n)_n w^n}{(d)_n n!} K_3 \left( a, a, a; b_1 + n, b_1 + n, b_2 + n, b_2 + n; a, a, a; x, x, z, z \right) = H_A \left( b_2, b_1, a - \frac{1}{2}; d, 2a - 1; w, 4x, 4z \right),
\]

(5.1)

On taking \(t = 0\) in (2.3), (2.4), (2.7) and (2.8) respectively, we get the following results:

\[
\sum_{n=0}^{\infty} \frac{(a_n)_n(a_n)_n w^n}{n!} F_T \left( b_1 - a_1, a_1; a_2 + n, a_2 + n; b_1, b_1; z, y, x \right) = (1 - z)^{-a_2} F^{(3)} \left( -:: a_1; a_3; a_2::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-::<::-:<
\[ (1-x)^{-a_1}(1-z)^{-b_1} F_1 \left[ b_1, a_2, b_2 ; c_1 ; \frac{z}{z-1}, \frac{w}{(1-x)(1-z)} \right] \] (5.5)

respectively, where \( F_1 \) and \( F_2 \) are Appell's Functions \[4; p.53\] and \( F_T \) is Saran's Function \[4; p.67\].

In (2.6), if we put \( b = c \) and \( x = y = \frac{1}{2}v \), then we get

\[
\sum_{n=0}^{\infty} \frac{(a)_n w^n}{n!} K_{10} \left( a+n, a+n, a+n, a+n; b_1, b_1, c_1, c_1, b_1, b_1, 2c_1, 2c_1; \frac{1}{2}v, \frac{1}{2}v, 2z, 2t \right) = K^{-a} F_c^{(3)} \left[ \frac{a}{2}, \frac{a+1}{2}; b_1, c_1 + \frac{1}{2}, c_2 + \frac{1}{2}; \frac{v^2}{K^2}, \frac{z^2}{K^2}, \frac{t^2}{K^2} \right] (5.6)
\]

In (2.7), if we put \( b = c \), then we get

\[
\sum_{n=0}^{\infty} \frac{(a)_n w^n}{n!} K_{13} \left( a+n, a+n, a+n, a+n; b_1, b_1, c_1, c_2, 2b_1, 2b_1, 2c_1, 2c_2; 2x, 2y, 2z, 2t \right) = K^{-a} F_c^{(3)} \left[ \frac{a}{2}, \frac{a+1}{2}; b_1 + \frac{1}{2}, c_1 + \frac{1}{2}, c_2 + \frac{1}{2}; \frac{(x-y)^2}{K^2}, \frac{z^2}{K^2}, \frac{t^2}{K^2} \right], (5.7)
\]

where \( F_c^{(3)} \) the Lauricella's Function of three variables \[4; p.60\] and \( K = (1-x-y-z-t-w) \).
References:

A Study Of Wound Healing By Local Injection of Insulin

دراسة عن التئام الجروح بحقنة أنسولين موضعية

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2015
ISSN : 2410-7727
ISSN : 2410-7735
AUST
Objectives: In this prospective study we aim to demonstrate the effect of small doses of topical long acting insulin (zink insulin) application in wound healing.

Methods: Thirty eight patients were studied in our private outpatient clinic between the years 2009 to 2011, long acting insulin (zinc insulin) was used to avoid the hypoglycemic effect of insulin.

Results: From a total of 38 patients, 20(52.6%) were males and 18(47.4%) were females. The median age was 49 years with a mean age of 35.11±11.543 years. There were different causes of the wounds, 21(55.3%) patients had previous operations leading to the wound, 9(23.7%) developed chronic wounds after burns, and 8(21.0%) had a wound due to trauma. The wounds were distributed in different sites of the body. In the trunk 24(63.2%) patients, in the extremeties 11(28.9%) patients and in the breast 3(7.9%). All the wounds were previously dressed with saline. The sizes of the wounds varied, minimum wound size was 1cm and maximum was 16cm with a mean of 6.32±4.319cm. 13(34.2%) of the wounds were infected, 18(47.4%) had allergy to stitches, 4(10.5%) had unhealthy granulation tissue and 3(7.9%) were covered with tough fibrin. These wounds were prepared prior to the study by giving antibiotic, removing the stitches, excising bad granulation tissue and removing fibrin. Soluble Insulin injection was prepared at a concentration of 1-Unit/10ml distilled water, then injected superficially in the inside of the wounds of the patient, and the effect was observed. The time range of saline-insulin treated wound closure was 15 days with a mean of 7.13±4.461 days. All patients had an excellent outcome and their wounds closed in a short time without any complications.

Conclusion: Topical insulin application leads to acceleration of wound healing. The duration of wound healing and outcomes in our study were excellent. This depends on many factors also which should be taken seriously like wound infection of the wound and size.
Keywords: Insulin, diabetes, topical insulin, neutrophils, MIP-2, anti-neutrophil antibodies, wound healing.

Objectives: To study the effects of small doses of long acting (zinc insulin) injected locally in wound healing.
Introduction:

In the early 20th century, insulin was first used to treat diseases other than diabetes.\(^1\)\(^2\) various animal models showed that systemic insulin treatment accelerated healing from fractures, skin cuts, and skin ulcers.\(^3\)\(^4\)\(^5\)\(^6\) Low-dose topical insulin stimulated migration of keratinocytes and vascular endothelial cells through the insulin receptor-mediated pi3k-akt-rac1 signal pathway. These events promoted re-epithelialization and wound healing.\(^7\)\(^8\)

It has been reported that insulin regulates systemic inflammatory responses, the cellular functions of neutrophils in the wound area. Low-dose topical insulin application decreases wound neutrophil infiltration and advanced wound neutrophil attenuation,

Neutrophils are the main type of cells that are involved in the inflammatory response. They clean exogenous pathogens through phagocytosis and release enzymes and Reactive Oxygen Species (ROS) to kill bacteria and other intruders. Macrophages also have the function of phagocytosis, therefore neutrophils are not essential to wound healing, since it has been shown that anti-neutrophil antibodies do not interfere with healing.\(^9\) On the contrary, depletion of neutrophils facilitates wound healing and improves the quality of recovery.\(^10\) Additionally, prolonged neutrophil infiltration may contribute to impaired wound healing.\(^11\)

MIP-2, a member of the CXC chemokines family, strongly induces neutrophil chemotaxis.\(^12\) With topical insulin application, traumatic MIP-2 expression significantly decreases. Similarly with the change of MIP-2, wound neutrophils notably decreases. These observations suggest that topical insulin regulates the inflammatory response in the wounded area by restraining wound neutrophil infiltration through inhibition of chemokine MIP-2 expression. Vascular permeability also regulates inflammatory cell recruitment. Despite regulating MIP-2 expression, insulin stabilizes vessel endothelial barrier function.\(^13\)

It has been reported that diabetic wounds have elevated neutrophils and prolonged neutrophil infiltration.\(^13\) Conversely, neutrophils in wounds of patients with diabetes are dysfunctional in
terms of phagocytosis, migration, and bactericidal actions.\textsuperscript{(14)} The present findings of insulin-induced stimulation of neutrophil functions may help advance the clinical treatment of chronic, nonhealing diabetic wounds.

**Patients and Methods:**

Thirty eight patients suffering from acute and chronic wounds as a result of various types of trauma (surgical and accidental) were collected from our private out-patient clinic during the years 2009-2011. They were randomly selected to receive local insulin injection directly in to the wounds during their wound dressings. The chronic wounds could not close inspite of the previous dressings. Acute wounds which were recently acquired were taken into the study too. Patients with diabetes mellitus were excluded for fear of interference with their normal regimen, otherwise all other types of patients were accepted.

Each patient was dealt with independently. A clinical record was created for each patient. Full history was taken and physical examination was performed and the wounds were carefully inspected and all positive findings were recorded. Any pathological conditions in the wounds were treated and the wounds were prepared in advance before the commencement of the study. Infections were treated by appropriate antibiotics, allergic surgical stitches were extracted, unhealthy granulation tissue was excised and fibrin was removed.

To all these patients a peripheral IV line was established for emergency purposes and they were asked to take a heavy meal before coming. Just before starting the study a series of procedures were performed.

1- A concentrated glucose solution (40\%) was injected intravenously.
2- The wounds were cleaned with physiological solution.
3- Long acting insulin (zinc insulin) was used for this study (soluble insulin was not used to avoid sudden hypoglycemia).
Insulin solution was prepared at a concentration of 1.0 Unit of insulin dissolved in 10cc distilled water. 4-This solution was injected evenly throughout the inside of the wound, and this concentration was maintained for all patients throughout the study. 5-A sterile dry gauze was applied 6-and the wounds were dressed. These steps were done daily for each patient.

**Results:**

The study was done on 38 patients 20(52.6%) were males and 18(47.4%) females. (Table 1).

**Table 1: Patients distribution according to sex**

<table>
<thead>
<tr>
<th>Sex</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>18</td>
<td>47.4</td>
</tr>
<tr>
<td>Males</td>
<td>20</td>
<td>52.6</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The ages of the patients were between 17 years and 66 years, with a mean age of 35.11 ± 11.543. median was 49.

Wounds due to operations accounted for more than 50% of the patients, i.e. 21(55.3%) while burns and trauma accounted for 9(23.7%) and 8(21.0%) respectively. (Table2).

**Table 2: Distribution of the patients according to the causes of the wounds**

<table>
<thead>
<tr>
<th>Causes of the wounds</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations</td>
<td>21</td>
<td>55.3</td>
</tr>
<tr>
<td>Burn</td>
<td>9</td>
<td>23.7</td>
</tr>
<tr>
<td>Trauma</td>
<td>8</td>
<td>21.0</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Most of the wounds were in the trunk 24(63.2%) patients, followed by the extremities 11(28.9%) patients, then in the breast 3(7.9%). (Table3).

**Table 3: Distribution of the patients according to the sites affected**

<table>
<thead>
<tr>
<th>Sites of the wounds</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunk</td>
<td>24</td>
<td>63.2</td>
</tr>
<tr>
<td>Extremities</td>
<td>11</td>
<td>28.9</td>
</tr>
<tr>
<td>Breast</td>
<td>3</td>
<td>7.9</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100</td>
</tr>
</tbody>
</table>

All patients were managed previously i.e. after their first insult, by the usual classical dressings with saline and iodine, some of the patients were submitted to various surgical interventions on the same area of the wound.

The wounds varied in size between 1 to 16 cm. With a mean size of 6.32±4.319cm. The smallest wound was as a result of deep burns and grossly thick fibrosis was impairing its closure.

Nearly half of the patients 18(47.4%) had stitch allergy while 13(34.2%) of the wounds were infected. The infected wounds had been treated for a long time with local antibiotics without improvement. On examination they were covered by thick fibrosis wall. 4(10.5%) had unhealthy hypergranulation tissue preventing tissue advance and 3(7.9%) had tough fibrin covering the wound and hindering it from closure. (Table5).

**Table5: Distribution of the patients according to the clinical condition of the wounds**

<table>
<thead>
<tr>
<th>Type of wound</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infected</td>
<td>13</td>
<td>34.2</td>
</tr>
<tr>
<td>Stitch allergy</td>
<td>18</td>
<td>47.4</td>
</tr>
<tr>
<td>Granulation tissue</td>
<td>4</td>
<td>10.5</td>
</tr>
<tr>
<td>Tough fibrin</td>
<td>3</td>
<td>7.9</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100</td>
</tr>
</tbody>
</table>

The stitches were causing distortion of the wound and even after stitch removal the wound was still distorted and deprived of blood supply which was hindering their proper closure.

A solution of 1.0-Unit of soluble insulin dissolved in 10cc of distilled water was used as local injections. The average time of wound closure treated with saline and insulin was 15 days, with a range of 1 day and to 16 days and a mean of 7.13±4.461 days (Table6).
Table 6: Time of closure

<table>
<thead>
<tr>
<th>Statistical description</th>
<th>No.</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std.Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of patients</td>
<td>38</td>
<td>49</td>
<td>17</td>
<td>66</td>
<td>35.11</td>
<td>11.543</td>
</tr>
<tr>
<td>Size of wounds</td>
<td>38</td>
<td>15</td>
<td>1</td>
<td>16</td>
<td>6.32</td>
<td>4.319</td>
</tr>
<tr>
<td>Closure time in days for saline-insulin treated</td>
<td>38</td>
<td>15</td>
<td>1</td>
<td>16</td>
<td>7.13</td>
<td>4.461</td>
</tr>
</tbody>
</table>

The prognosis of all the 38 patients was excellent, they showed accelerated and healthy closure of the wounds (Table 7).

Table 7: Prognosis

<table>
<thead>
<tr>
<th>Prognosis</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>38</td>
<td>100</td>
</tr>
<tr>
<td>Bad</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100</td>
</tr>
</tbody>
</table>

Discussion:

Insulin is a hormone known primarily for regulating sugar levels in the blood but recently researchers at the University of California, Riverside, found that applying insulin directly to skin wounds significantly enhanced the healing process.

Wound healing is divided into 3 sequential, overlapping, phases: inflammatory, proliferation, and remodeling. In the early 20th century, insulin was first used to treat diseases other than diabetes. (15)

It has been reported that insulin regulates systemic inflammatory responses, whereas the regulation of traumatic inflammation by topical insulin has not been studied. (16) Liu Y and Zhang XJ, et al. reported in their study that low-dose topical insulin application also promoted healing of thermal traumas in rats and incision wounds in rabbits. (17,18) Local injection of small dose of insulin may accelerate burn wound healing due to its role in promoting the proliferation and division of the repairing cells (19)
Low-dose topical insulin stimulates migration of keratinocytes and vascular endothelial cells through the insulin receptor-mediated PI3K-Akt-Rac1 signal pathway. These molecular events could trigger re-epithelialization and angiogenesis, and hence, promote wound healing.\(^{(20,21)}\)

The present study showed that low-dose topical insulin application increased the rate of wound healing among the studied patients.

The age range our patients was wide from 17 years to 66 years, but no age group showed more rapid wound healing over the other. Both sexes and all ages showed equally accelerated healings.

The most common cause of the wounds in our study was post-operative. Wound infection coupled with allergy to suture materials used in our hospitals. The other cause was burns secondary to gas explosion which is common in our set up. Wounds secondary to trauma were few. \(^{(22)}\)

Some wounds were acute and others chronic. The periods of the previous dressings in the patients in our study were variable, starting from two days after the primary insult- in patients with trauma - up to more than 3.5 months in patients with operations and burns. “Xuelian Chen, MD, et al. ” published a study on topical use of insulin to accelerate wound healing on recent self made wounds on mice.\(^{(22)}\)

All patients in our study got primarily the same usual classical dressing i.e. saline and iodine dressings, before arriving to our care.

Our patients showed varying sizes of the wounds. From 1cm. to 16cm. with a mean size of 6.32±4.319cm.

At the examination of the wounds, nearly half of the wounds had allergy to the nonabsorbed suture material with stitch infection. This was true in 18(47.4%) patients who were operated previously. This may be attributed to the high affinity that our patients exhibit towards developing allergy to surgical sutures. A great number of our patients had postoperative wound infection 13(34.2%), which reflects the high rate of postoperative infections. Unhealthy granulation tissue occupied the third place among the causes of open wounds in our patients 4(10.5%), a fact commonly seen in our
practice due to the improper management of the wounds and neglect of therapy in most patients, while 3(7.5%) had tough fibrin, probably due to insufficient wound care in the patients. The last two arrest the skin from progressing. All these were important factors that kept the wounds open.

In the year 2012 in Fudan University (Shanghai, China), Xuelian Chen, MD, et al. used 0.03-U insulin dissolved in 20-μL saline to inject mice for the purpose of their wound healing. In another study on animals in (1983), Hanam SR, Singleton CE, et al. have reported that insulin at a concentration of 0.5 U/100g gives best effect on wound healing. In our study we used 1.0-Unit of soluble insulin diluted in 10cc. distilled water. This is a concentration little higher than that reported in studies in other countries, but it did give us excellent results without complications. To avoid any hypoglycemic effect we injected the patients with 40% glucose solution prior to insulin injection each day.

Xuelian Chen, MD, et al. recorded a mean time of wound closure of 6.67 ± 0.52 days, which was significantly shorter than that of the saline treated wounds 8.17 ± 0.75 days in their study; and a P<0.05. In our patients the wounds had a mean time of closure of 7.13 ± 4.461 days.

All patients who were treated with insulin got complete and accelerated wound healing.

**Conclusion:**

Topical insulin application leads to acceleration of wound healing. The duration of wound healing and outcomes in our study were excellent. This depends on many factors also which should be taken seriously like wound infection of the wound and size.
References:

22. Xuelian Chen, MD, Xiong Zhang, MD, PhD, Yan Liu, MD, PhD: Wounds. 2012;24(7):178-184