The Relation between Left Coronary Dominancy and Atherosclerotic Involvement of Left Anterior Descending Artery Origin

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ABSTRACT

Introduction: Limited information is available regarding the relationship between coronary vessel dominance and atherosclerotic involvement. Rheological factors have been implicated in the pathogenesis of coronary lesions. More than 90% of the coronary blood flow enters the left coronary if it is the dominant artery. The main purpose of this study was to determine the relation between left coronary dominance and atherosclerotic involvement of left anterior descending artery (LAD) origin. In addition, the prevalence and degree of associated ischemic mitral regurgitation (MR) in these patients were assessed. Methods: The study included 678 consecutive patients with an indication for coronary angiography. One hundred and twenty two patients with right dominant and 61 patients with left dominant arteries were randomly selected for analysis. All demographics, risk factors, coronary dominancy and involvement, left ventricular ejection fraction (LVEF), and MR were recorded. Results: One hundred and eighty three patients (mean age of 57.7 years) were studied. The types of coronary circulation included right, left, and balanced in 78.6%, 8.9%, and 12.5%, of the patients respectively. In 64 patient with significant LAD lesions, 22 (34.9%) had ostial while the remainder had non-ostial involvement. Ischemic MR was present in 5 (2.7%) patients. There was no difference in demographics, risk factors, LVEF, MR, extent of coronary artery disease, and LAD ostial involvement between left and right dominant circulations. Conclusion: In this study, left coronary dominance was not associated with atherosclerotic involvement of LAD ostium and ischemic MR.

Introduction

The coronary circulation was first described by Banchi in 1904. Later on, Hettler, provided very detailed criteria for the type classification based on the course of the anterior and posterior interventricular branches and defined the following types: left coronary artery dominance, right coronary artery dominance, and co-dominant or balanced. There are 3 types of circulation dominance: right, left, and balanced. When the arteries supplying the posterior interventricular septum originate from posterior descending artery and posterior lateral right coronary artery, it is called “right dominant (RD)” circulation. The dominance of right circulation is common in about 87-89% of the general population. The term “left dominance (LD)” refers to origination of the arteries supplying the posterior interventricular septum from left circumflex artery (LCX). The rate of the dominance of left circulation for the general population is about 7-8%. In co-dominance (balanced) circulation, however, the branches that run to the interventricular septum originate both from the RCA and LCX. The rate of co-dominance in the general population is around 4%. Understanding of the anatomy of the major epicardial coronary arteries and their major branches is clinically important in the management of cardiovascular diseases and accompanying complications such as myocardial ischemia and sudden cardiac death. Rheological factors have been implicated in the pathogenesis of coronary artery disease (CAD). Locally disturbed flow could induce alterations that promote the steps of early atherogenesis. Intimal damage appears to be related to shear stresses as endothelial cell damage occurs at high shear rates. More than 90% of the coronary blood flow enters the left coronary if it is the dominant artery, producing high shear stress at its bifurcation.

The main purpose of this study was to determine the relation between left coronary dominance and atherosclerotic involvement of the origin of left anterior descending artery (LAD). In addition, the prevalence and
Materials and methods
This prospective study included 678 consecutive patients with an indication for coronary angiography referred to Madani Heart Center in 2011. Patients with non-ischemic MR were excluded. One hundred and twenty-two patients with RD and 61 patients with LD circulations were randomly selected for analysis. All demographics, risk factors, left ventricular ejection fraction (LVEF), and MR were recorded. Familial CAD was defined as the presence of coronary artery disease in first-degree family members at <55 years in men and <65 years in women. Hypertension was defined as the current use of antihypertensive medication or an average blood pressure >140/90 mmHg on two different occasions. Hyperlipidemia was defined by serum cholesterol levels > 250 mg/dl, serum triglyceride levels > 200 mg/dl, or use of anti-lipid drugs. A diagnosis of diabetes mellitus was made if the patient needed insulin, oral agents or had fasting blood glucose ≥ 126 mg/dl. Angiography of the right coronary artery was performed in at least 2 projections and the branches of the left coronary artery in at least 3. Coronary angiograms were digitally saved and each angiogram was analyzed by 2 experienced cardiologists blinded to clinical data; coronary dominancy and the extent and location of coronary involvement were determined. In the few cases where assessment differed, the film was reviewed again in the presence of the complete angiography assessment committee until a consensus was achieved. CAD was defined as more than 50% diameter stenosis in one or more of the three major coronary arteries (LAD, LCX, and RCA) or their major branches. Subcritical stenosis of less than 50% was characterized as minimal CAD. The extent of coronary artery disease was noted as 1-, 2- or 3-vessel disease. LVEF was semi-quantitatively analyzed by transthoracic echocardiography before discharge by an operator who was blinded to the patient data and the location of infarction. All patients gave written informed consents and the study was approved by our local Ethics Committee.

Statistical analysis
Variables were expressed as mean ± SD and percentage. Differences in the frequency of characteristics were assessed by independent sample Student’s t-test for continuous variables. Chi-squared test (or Fisher exact test if applicable) was used for categorical variables. Two-tailed P < 0.05 was considered significant. SPSS 13.0 software (SPSS Inc., Chicago, IL, USA) was used for data storage and analysis.

Results
One hundred and eighty three patients were studied. The mean age of the patients was 57.96±1.12 (27-90) years while 67.6% were male (Table 1). There was no significant difference in demographics, CAD risk factors, LVEF, diagnosis during admission, and the extent of coronary involvement (Table 1). The types of coronary circulation were right, left, and balanced in 78.6%, 8.9%, and 12.5%, respectively. In 64 patient with significant LAD lesions, 22 (34.9%) had ostial while the remainder (65.1%) had non-ostial involvement. When we considered coronary dominancy, no significant difference in the involvement of LAD ostium was observed between groups (33.3% vs. 37.5%; P= 0.73). Although ischemic MR seemed to occur more commonly in the LD group, the difference was not statistically significant. There was a trend for more involvement of proximal LAD in the LD group (P= 0.09) which did not reach to a statistical significance (Table 1).

Discussion
Our study indicated that, although RD circulation is more common in the general population, there may be no association between left coronary dominancy and atherosclerotic involvement of LAD ostium and prevalence of ischemic MR. Understanding coronary artery variations and pathologies is important in planning the treatment and in the interpretation of findings of cardiovascular diseases. Coronary artery dominancy and its clinical importance should be known by cardiovascular specialists and be included in their interpretations. Such anatomical variations have been involved in pathophysiology of cardiac arrhythmias, MI, and even in sudden death. The coronary circulation was first described by Banchi in 1904. Later on, Hettler, provided very detailed criteria for the type classification based on the course of the anterior and posterior interventricular branches and defined the following types: left coronary artery dominance, right coronary artery dominance, and co-dominant or balanced. There are limited and conflicting results on the prognostic and therapeutic implications of coronary variations and dominancy. Dodge et al. and Kaimkhani et al. both found that the diameter of the left main coronary artery (LMCA) and LAD were unaffected by dominancy. In the study conducted on 541 patients by Balci, it was shown that the dominancy in the coronary circulation does not predispose to coronary atherosclerosis. This result was in contrast to the findings of another study by Vasheghani-Farahani, which stated a significantly higher predisposition to 3-vessel involvement in RD patients even after adjusting the data for age, sex, and coronary risk factors. RCA and LCX were more involved in RD patients, but dominancy had no effect on LAD disease. Goldberg et al. demonstrated that LD is a significant and independent predictor of increased long-term mortality in patients with acute coronary syndrome (ACS). Although the association between coronary dominancy and mortality was similar across the whole spectrum of ACS, it was more pronounced in patients with MI.
Coronary dominancy and LAD origin involvement

Table 1. Demographic, echocardiographic, and angiographic findings in both groups

<table>
<thead>
<tr>
<th></th>
<th>Right dominant coronary circulation</th>
<th>Left dominant coronary circulation</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>58.42±10.77</td>
<td>57.03±12.30</td>
<td>0.43</td>
</tr>
<tr>
<td>Male (%)</td>
<td>69.7</td>
<td>65.6</td>
<td>0.57</td>
</tr>
<tr>
<td>Familial CAD* (%)</td>
<td>4.1</td>
<td>3.3</td>
<td>0.78</td>
</tr>
<tr>
<td>Hyperlipidemia (%)</td>
<td>27.0</td>
<td>21.3</td>
<td>0.39</td>
</tr>
<tr>
<td>Hypertensive (%)</td>
<td>47.5</td>
<td>41.0</td>
<td>0.40</td>
</tr>
<tr>
<td>Diabetic (%)</td>
<td>23.8</td>
<td>21.3</td>
<td>0.70</td>
</tr>
<tr>
<td>Active smoker (%)</td>
<td>29.5</td>
<td>36.1</td>
<td>0.36</td>
</tr>
<tr>
<td>LVEF* (%)</td>
<td>47.66±9.86</td>
<td>48.77±10.02</td>
<td>0.48</td>
</tr>
<tr>
<td>Diagnosis during admission</td>
<td></td>
<td></td>
<td>0.09</td>
</tr>
<tr>
<td>STEMI§ (%)</td>
<td>32.8</td>
<td>25.4</td>
<td></td>
</tr>
<tr>
<td>NSTEMI/UA† (%)</td>
<td>46.6</td>
<td>37.3</td>
<td></td>
</tr>
<tr>
<td>Stable angina (%)</td>
<td>14.7</td>
<td>30.5</td>
<td></td>
</tr>
<tr>
<td>Others (%)</td>
<td>6.0</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>Coronary involvement</td>
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</tr>
<tr>
<td>Single vessel disease (%)</td>
<td>25.4</td>
<td>36.1</td>
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<tr>
<td>Two vessel disease (%)</td>
<td>26.2</td>
<td>19.7</td>
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<tr>
<td>Three vessel disease (%)</td>
<td>27.9</td>
<td>18.0</td>
<td></td>
</tr>
<tr>
<td>Minimal CAD*</td>
<td>20.5</td>
<td>26.2</td>
<td></td>
</tr>
<tr>
<td>Proximal LAD lesion (%)</td>
<td>40.2</td>
<td>54.1</td>
<td>0.07</td>
</tr>
<tr>
<td>Ostial LAD lesion (%)</td>
<td>33.3</td>
<td>37.5</td>
<td>0.73</td>
</tr>
<tr>
<td>Ischemic MR‡ (%)</td>
<td>1.60</td>
<td>4.90</td>
<td>0.44</td>
</tr>
<tr>
<td>Mild (%)</td>
<td>2.5</td>
<td>1.6</td>
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<tr>
<td>Moderate (%)</td>
<td>1.6</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>Severe (%)</td>
<td>0.0</td>
<td>1.6</td>
<td></td>
</tr>
</tbody>
</table>

Coronary artery disease; ¶ left ventricular ejection fraction; § ST elevation myocardial infarction; † unstable angina; ‡ myocardial regurgitation.

Pathogenesis of CAD. Locally disturbed flow could induce alterations that promote the steps of early atherogenesis. Intimal damage appears to be related to shear stresses because endothelial cell damage occurs at high shear rates. More than 90% of the coronary blood flow enters the left coronary if it is the dominant artery, producing high shear stress at its bifurcation. A short LMCA trunk would maximize this high shear stress at its bifurcation and actually a study has considered this anatomic variation as a risk factor in developing coronary atherosclerosis.14 Eren et al.15 included 325 consecutive patients who underwent computed tomography coronary angiography (CTA) and showed that although the number of patients with CAD was higher among RD subjects, the rate of atherosclerotic CAD was significantly higher among the LD patients. In a recent study by Veltman et al.16 on 1425 patients referred for CTA the presence of a LD circulation was identified as an independent predictor of non-fatal MI and all-cause mortality, especially in patients with significant CAD on CTA.

We could not confirm our hypothesis on the relation between left dominancy and LAD involvement and occurrence of ischemic MR, most probably because of insufficient sample size. Although there was a trend for more involvement of proximal LAD in the LD group, this did not reach to a statistical significance (P= 0.09). On the other hand, ischemic MR seemed to occur more commonly in the LD group, the difference was not statistically significance (P= 0.44; Table 1).

Limitation

Probably the most important limitation of this study was its relatively small patient population, which results in a comparatively small group of patients with a LD coronary artery circulation. Of note, the prevalence of RD, LD, and balanced coronary artery circulation in the present

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study population was comparable to that described in the previous studies.\textsuperscript{10,12-15} Because of the small patient groups among patients with significant CAD, statistically significant difference between the risk estimates for having a significant stenosis in LAD in patients with a RD and LD coronary circulations was not observed, presumably due to insufficient power. Larger studies are needed to elucidate the relationship between significant stenosis of LAD and the dominancy of the coronary circulation.

Conclusion
Left coronary dominance might not be associated with atherosclerotic involvement of LAD ostium and ischemic MR.

Competing interests: The authors declare that they have no competing interests, and did not receive funding for this article.

References
Risk Factors of Congenital Heart Diseases: A Case-Control Study in Northwest Iran

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Introduction: Congenital heart diseases are of immense importance and also a high prevalence. Contributing factors to developing these defects have not been abundantly studied. Therefore, the current study was conducted aiming at determining the effective factors on Congenital Heart Disease (CHD) in newborn infants of Northwest Iran.

Methods: A case-control study was carried out in North-West of Iran from 2002 to 2012 and a total of 473 infants entered the study. Required data were obtained through check lists completed by the information of hospital records and interview with mothers of 267 newborn infants with CHD together with medical records of mothers as the case group, and 206 medical records of healthy infants at the same period all together with those of their mothers as the control group. The obtained data were statistically analyzed using descriptive statistical methods, T-test, Spearman’s correlation coefficient, and Multi-variable Logistic Regression Model (OR with 95% CI), using SPSS.19. In the present study, P value less than 0.05 was considered statistically significant.

Results: Based on the results of univariable analyses, the number of previous cesarean sections, past medical history of diseases, gestational age (GA), fetal weight at birth, diastolic blood pressure, fetal heart rate, pulse rate, fetal hemoglobin and hematocrit levels, and fetal head circumference at birth have significant relationship with incidence of congenital abnormalities (P<0.05). Family history, past cesarean sections history, past medical history and GA had significant relationship with CHD incidence.

Conclusion: Based on the results of present study, in order to control and reduce the cases of CHD, it is crucial to make proper decisions and implement policies for reducing cesarean cases, lowering consanguineous marriages, providing proper pre-marriage counseling, prompt treatment of mothers’ illnesses, improving pregnancy health care and mothers’ health status for the purpose of better well-being of newborn infants.

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Iran

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Introduction
Congenital Heart Diseases (CHD), affecting infants since birth onward¹, are one of the most common health dilemmas and mortality causes of newborn infants.² This malady is usually due to abnormal development or lack of growth of fetal organs. The problems of these diseases are usually tolerable during intrauterine life but their complications emerge with the birth of infant, closure of the arterial ducts and foramen oval and termination of fetal blood circulation.³ Various statistics estimate the global prevalence of 4 up to 10 cases per 1000 live births for these diseases.⁴ However, in general, the prevalence of this disease is approximated as eight in 1000.⁵ A clinical study in Iran showed a mean prevalence of 12.30 per 1000 live births between 1998 and 2007.⁶ Recent studies conducted for identifying the contributing factors in incidence of this disease have figured out various factors which could be generally divided into two groups of environmental and genetic factors. Recently, it has been declared that the effect of the environmental factors is much more than that of the genetic factors, but still there is very limited and incomplete data about main reasons for incidence of this disease.⁷,⁸ Among the most important factors the following have been studied in most of surveys: the individual social variables such as occupation, educational background, health status, smoking and alcohol consumption habits of...
mother, mothers’ past medical history and emotional status, family history of disease, consanguineous marriages, sex, age, delivery method and many other factors. There are very limited studies on determining effective factors of these diseases in Iran and available data identifying effective factors have mainly been obtained from studies of other countries. As well as other diseases, lack of accurate data on effective factors of its incidence may lead to undesirable outcomes in treatment and prevention of this disease. Therefore, in order to make proper planning and decision in controlling and managing these diseases, it is necessary to conduct accurate studies to identify effective factors in developing these diseases. The present study aimed to investigate causative factors in frequency of CHD in newborn infants in Northwest Iran.

Materials and methods
The participants of this case-control study were newborn infants as well as their mothers whose information had been collected from Tabriz Alzahra and Madani Educational and Medical Centers, Tabriz, Iran. In this study, a total of 473 newborn infants with their mothers were enrolled into study between 2002 and 2012. All hospital records of newborn infants with CHD, consisting of a total of 267 cases with hospital records of their mothers were selected and used as the case group in the study. Meanwhile, 206 hospital records of healthy infants who were born in this center at the same period and in similar conditions with that of the case group were selected randomly and used as the control group. Required information was collected using checklists of hospital records of infants and their mothers as well.

The variables included: mother’s age, family history, number of gravidities, infant’s sex, weight at birth, smoking and alcohol consumption habits of mother, consanguineous marriages, cesarean section history, fetal head circumference at birth, postnatal care (PNC) of mother, body mass index (BMI) of mother during pregnancy, mother’s diseases and received therapies, diastolic and systolic blood pressure, gestational age (GA), fetal heart rate (FHR), pulse rate (PR), hemoglobin (Hb), hematocrit (Hct) and other variables. Inclusion criteria for the case group were having CHD and exclusion criteria were having other congenital defects and developing respiratory distress syndrome. Inclusion criteria for the control group included well-being from all aspects and birth in the same period (during 2002-2012). Studied mothers in both groups were same in terms of consanguinity exists in most cases in blood groups O (65.5%), A (61%), B (54.3%), and AB (18.2%).

Analyzing the results showed that mother and infant consanguinity exists in most cases (P<0.001) in which the most consanguinity occurs in blood groups O (65.5%), A (61%), B (54.3%), and AB (18.2%). In terms of weight, the weight of 27.7% of infants in case group was less than 1500 g and about 11.7% were above 3500 g; while these figures in the control group were about 2% and 27.85% respectively. Results of Chi-square test showed that frequency distribution of weight in two study groups was statistically significant (P<0.001).

Other variables investigated in the present study were summarized in Table 2. The results of some studied variables such as illness, alcohol and smoking habits and blood/Rh group were not reportable in terms of significant and statistical comparison which was due to incomplete recording system in medical centers and cultural concerns. Generally, diabetes mellitus and hypertension were more prevalent in the case group. Alcohol consumption habits were reported only in 1 case. Smoking habit was observed only in one case in the control group and none of the mothers in case group had history of either smoking or alcohol consumption habits.

As shown in Table 2, except for systolic hypertension, PNC and delivery method, other variables had significant relationship with frequency of CHD. By increasing the number of cesarean deliveries, the risk of developing CHD increased in infants Among all cases, variables reported as significant in simultaneous logistic model were presented in Table 3.

Discussion
Congenital Heart Diseases (CHD) are one of the most prevalent causes of mortality in children. In recent years researchers declared various culprits for developing this disease. Generally, they divide these factors into two categories of environmental and genetic ones. Considering the fact that these factors could be different in various
Table 1. Demographic Characteristics of Case and Control Groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>Case Group (N=267)</th>
<th>Control Group (N=206)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>147 (55.1)</td>
<td>117 (56.8)</td>
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<tr>
<td></td>
<td>Female</td>
<td>120 (44.9)</td>
<td>89 (43.2)</td>
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<tr>
<td>Gestational Age (w)</td>
<td></td>
<td>34.7±1.46</td>
<td>38.8±2.76</td>
<td>&lt;0.001</td>
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<tr>
<td>Mother’s Age (y)</td>
<td></td>
<td>28.3±1.68</td>
<td>27.1±1.69</td>
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<tr>
<td>Infant’s Weight (gr)</td>
<td></td>
<td>2359.7±1003.92</td>
<td>3185.7±649.31</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mother’s Weight (kg)</td>
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<td>74.6±12.63</td>
<td>77.0±13.5</td>
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<td>Familial Marriage History</td>
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<td>61 (22.8)</td>
<td>37 (18)</td>
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<td>Infant’s Blood Group</td>
<td>A</td>
<td>73 (40.1)</td>
<td>4 (36.4)</td>
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<tr>
<td></td>
<td>B</td>
<td>36 (19.8)</td>
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<td></td>
<td>O</td>
<td>61 (33.5)</td>
<td>4 (36.4)</td>
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<td>AB</td>
<td>12 (6.6)</td>
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<td>Maternal Blood Group</td>
<td>A</td>
<td>100 (39.5)</td>
<td>72 (37.9)</td>
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</tr>
<tr>
<td></td>
<td>B</td>
<td>54 (21.3)</td>
<td>38 (20)</td>
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</tr>
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<td></td>
<td>O</td>
<td>86 (34)</td>
<td>64 (33.7)</td>
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<tr>
<td></td>
<td>AB</td>
<td>13 (5.1)</td>
<td>16 (8.4)</td>
<td></td>
</tr>
<tr>
<td>Infant Head Circumference (cm)</td>
<td></td>
<td>32.2±3.81</td>
<td>34.5±2.38</td>
<td>&lt;0.001</td>
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</table>

* Data were reported in Number (%) and Mean±SD pattern

Table 2. Comparison of Effective Factors Between Case and Control Groups

<table>
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<td>Delivery Type</td>
<td>NVD</td>
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<td>94 (45.6)</td>
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<td></td>
<td>C/S</td>
<td>163 (61)</td>
<td>112 (54.4)</td>
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<tr>
<td>C/S History</td>
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<td>187 (71.1)</td>
<td>163 (79.9)</td>
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</tr>
<tr>
<td></td>
<td>1</td>
<td>41 (15.6)</td>
<td>32 (15.7)</td>
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<td></td>
<td>2</td>
<td>28 (10.6)</td>
<td>6 (2.9)</td>
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</tr>
<tr>
<td></td>
<td>3</td>
<td>7 (2.7)</td>
<td>3 (1.5)</td>
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</tr>
<tr>
<td>PNC</td>
<td></td>
<td>81 (30.3)</td>
<td>67 (32.5)</td>
<td>0.61</td>
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<td>Blood Pressure</td>
<td>Systolic (mm Hg)</td>
<td>117.6±18.29</td>
<td>114.8±14.20</td>
<td>0.35</td>
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<td></td>
<td>Diastolic (mm Hg)</td>
<td>75.1±12.03</td>
<td>71.8±19.35</td>
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<td>FHR</td>
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<td>140.4±11.18</td>
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<td>Mother PR</td>
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<td>82.9±8.19</td>
<td>80.7±4.47</td>
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<td>Hemoglobin (HB)</td>
<td></td>
<td>12.1±1.76</td>
<td>11.7±1.33</td>
<td>0.007</td>
</tr>
<tr>
<td>Hematocrit (HCT)</td>
<td></td>
<td>37.1±5.42</td>
<td>35.9±3.85</td>
<td>0.005</td>
</tr>
<tr>
<td>Mother’s Diseases</td>
<td></td>
<td>69 (25.8)</td>
<td>23 (11.2)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

C/S: Caesarean, NVD: Normal Vaginal Delivery
PNC: Postnatal Care, FHR: Fetal Heart Rate, PR: Pulse Rate
* Data were reported in Number (%) and Mean±SD pattern

Table 3. Simultaneous Results of Variables in Logistic Regression Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>Crude OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consanguinity History</td>
<td>-0.77</td>
<td>0.28</td>
<td>0.45</td>
<td>0.26 – 0.79</td>
<td>0.005</td>
</tr>
<tr>
<td>Caesarean section History</td>
<td>-0.63</td>
<td>0.18</td>
<td>0.53</td>
<td>0.37 – 0.75</td>
<td>0.001</td>
</tr>
<tr>
<td>Mother’s Diseases</td>
<td>0.85</td>
<td>0.31</td>
<td>2.34</td>
<td>0.26 – 1.08</td>
<td>0.007</td>
</tr>
<tr>
<td>Gestational Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational Age ≥ 32 (w)</td>
<td>-9.23</td>
<td>1.24</td>
<td>1.01</td>
<td>0.26 – 1.08</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
regions, it is necessary to conduct national and even local surveys to identify contributing factors to developing this disease. Results of current study showed that among studied factors, previous cesareans history, cardiac disease history, GA, infant’s weight at birth, diastolic blood pressure, FHR, mother’s PR, hemoglobin, hematocrit, and fetal head circumference at birth had significant relationship with incidence of CHD. Also based on the results of logistic regression analysis, family history, cesarean section history, past medical history, and GA had significant relationship with the incidence of congenital heart diseases.

The results of the present study showed that the great number of past cesarean cases significantly raised the possibility of developing CHD in newborn infant. In most of other studies conducted in this field, it was found that by increasing the pregnancy numbers, specially cesarean deliveries and induced abortion, the possibility of CHD incidence increases.18-20 Therfore, proper controlling programs should be implemented in order to prevent and reduce pregnancies leading to cesarean delivery and induced abortion.

In the present study, among investigated diseases, the rate of diabetes mellitus and hypertension in the case group was significantly much more than that of the control group. In the studies conducted in some regions of the world such as China19,21, South America22 and Peru23, it has been showed that living in high altitude is a convincing factor in developing CHD and its reason is related to low oxygen level in height and raising of blood pressure as a consequence. Considering the fact that Azerbaijan province is a mountainous region, this factor could contribute to the increase in the prevalence of this disease. In this study, diabetes mellitus also runs in CHD group three times more than that of the healthy infants’ group. A study conducted on 470 infants in Boston (USA), showed that prevalence of CHD among infants with diabetic mothers was about 5 times more than that of infants with healthy mothers24 which was similar to the results of this study. Hence, more attention should be paid to the control of diabetes in pregnant mothers. In this study, no smoker was present in the case group and there was only one smoker in the control group. This hampered us to study the effect of smoking in developing CHD. The reason could be cultural as in Iran, especially Azerbaijan most women are not accustomed to smoking; however, in most of the previously conducted studies in other parts of the world, where smoking is common among women, there is a significant relationship between smoking and developing CHD. In a case-control study conducted in Lithuania, mothers’ smoking was reported as one of the main hazardous risk factors of developing CHD in newborn infants.25 Also in another case-control study conducted in that country, it has been shown that possibility for CHD risk in infants whose mothers had smoking habit during pregnancy is two times more than that of infants whose mothers do not smoke.26 Kallen et al. described in their study that there is a significant statistical relationship between the smoking habit of mothers and developing CHD in infants.27 Although smoking habit among women is too low in Iran especially in Azerbaijan, mothers must be aware of its dangers on their infants’ health.

Cardiac system evolution defect results in diminished perfusion in different organs, thus birth weight decreases. Also decreased perfusion results in defective cerebral structure evolution and low head circumference at birth. With regard to hypoxic condition of neonates suffering CHD, it is postulated that they have respiratory problems. Therefore, sympathetic system stimulation, diastolic blood pressure, PR HB and HCT increase, seems to be of great assistance in order to overcome this condition. Result of multi-variate regression analysis showed that consanguinity marriage had a significant relationship with CHD (OR=0.45 95%, CI=0.26 – 079, P=0.005). Studies conducted in Alexandria of Egypt28, Saudi Arabia29, and Lebanon30 showed that consanguinity marriage had a promoting effect on CHD risk. So, there should be plans to reduce consanguinity marriages along with providing more and better pre-marriage counseling services. This problem is a matter of concern in Iran, especially in rural areas where consanguinity marriages are more prevalent. Analyzing the birth age of infants showed that there was a significant relationship between infants’ age at birth and risk of CHD in two groups. In some other conducted studies it has been shown that the risk of developing CHD could increase in preterm birth infants which is due to incomplete development of cardiac tissues and structures and specially intratral and interventricular shunts remaining open.31 Consequently, the preterm birth of infants should be prevented by improving the quality of pregnancy cares.

Low number of variables that limits the possibility of more investigations and comparison with other studies is the notable weak point of this study. So it is suggested to survey diverse variables in future studies. Variables such as mothers’ educational background, mothers’ occupational status, abortion history, mental-psychological status of mothers, patients’ social and economic status, could be mentioned. The incomplete data is due to undependable hospital records in terms of recording and filing. More attention must be paid to the hospital records. It’s advised to conduct a general study with high number of patients in different centers of Iran at the same time.

Conclusion
Although the pattern and etiology of diseases in various parts of the world and even inside a country are different from one region to another, and due to scant studies conducted in our country in the field of CHD, the results of this study could provide authorities, policy makers, and health care providers with useful information about...
Risk factors of congenital heart diseases

Based on the results of this study, the most important and significant effective factors in developing CHD are repeated cesareans, family history, general health status of infant including birth age, weight at birth, heartbeat and etc. So, in order to improve general health of newborn infant, control and reduce of CHD cases, it seems necessary to plan and make policy for decreasing cesarean cases, decreasing consanguinity marriages, providing a proper counseling, recognizing dangerous pregnancies, prompt managing of mothers’ diseases, and improving pregnancy care and mothers’ health status.

Acknowledgments

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References

The Role of Esophagogastric Anastomotic Technique in Decreasing Benign Stricture Formation in the Surgery of Esophageal Carcinoma

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4Department of Surgery, 22-Bahman Hospital, Masjedsoleiman, Iran

ABSTRACT

Introduction: Postoperative stenosis and dysphagia after esophageal carcinoma resection is the major problem. The aim of this study is to compare two types cervical esophagogastric anastomosis in reduction of stricture formation in esophageal cancer surgery. Methods: The subjects of this study were 223 patients undergoing esophageal carcinoma resection during 1998 to 2007. Twenty two patients were excluded from the study because of recurrent malignancy of anastomosis, mortality and losing in follow up period. Two hundred and one patients remained by the end of study were classified into two groups: 98 patients were treated by routinely transverse hand-sewn cervical esophagogastric anastomosis (group 1); and 103 patients were treated by the proposed oblique hand-sewn esophagogastric anastomotic technique (group 2). All the operations were with high abdominal and left cervical incisions (Transhiatal esophagectomy). All patients of both groups were followed up at least 6-month for detection of anastomotic strictures. Results: Postoperative dysphagia occurred in 20 patients of group 1 versus 5 patients of group 2. In working up by rigid esophagoscopy, two patients of group 2 and four patients of group 1 had not true strictures. Anastomotic strictures occurred in 16 cases of group 1, versus 3 cases of group 2. Statistical comparative analysis results of two groups about stricture formation were significant (3% versus 16% P= 0.003). Conclusion: The oblique hand-sewn esophagogastric anastomotic techniques reduce markedly the rate of stricture formation after esophagectomy.

Introduction

Patient safety and acquiring skilled practice has always been of great importance for the physician of all eras.1-27 Churchill and Sweet reported a series of esophageal resections with successful anastomosis with hand-sewn technique in 1942. Apart from the four common forms of esophageal ressection transhiatal approach with gastric pull up (THE, Orringer) has been popular in our center. Dysphagia after transhiatal esophagectomy and cervical esophagogastric anastomosis is common and often related to anastomotic strictures. Recurrence of dysphagia after successful esophagectomy is a major problem affecting normal swallowing.28 Although the esophagogastric anastomosis can be hand-sewn or stapled, the former technique is an easier and cheaper technique compared to the later one. Transverse hand-sewn cervical esophagogastric anastomotic technique is common in some centers as ours. The oblique hand sewn cervical esophagogastric anastomosis has been being used in our center since 2002. In the present retrospective comparative study, the advantages of two above mentioned surgical methods in the surgery of esophageal carcinoma have been evaluated and discussed.

Materials and Methods

Study design

This study is a retrospective analysis of the medical records of patients with surgery of esophageal cancer admitted in our referral center, Thoracic surgery ward of Imam Reza Hospital affiliated to Tabriz University of Medical Science. This study compares two types of cervical hand-sewn esophagogastric anastomotic technique in formation of stricture after esophageal cancer surgery. The study was carried out from 1998 to 2007 after being approved by ethical review board of Tabriz Medical Sciences University.

Patients

From 1998 to 2007, two hundred and twenty three patients with proven esophageal carcinoma were enrolled in this...
study.

Inclusion criteria in the present study were (201 patients):
1. All types of esophageal cancers (Squamous cell carcinoma with 198 patients and 3 patients of adenocarcinoma) without preoperative radiotherapy treatment history, and absence of distant metastasis being confirmed by preoperative sonography or CT scan studding.
2. 98 patients with transverse hand sewn esophagogastric anastomosis.
3. 103 patients with oblique hand sewn esophagogastic anastomosis.

Twenty two patients were excluded from the study based on the following criteria:
• 6 patients with malignant stricture formation after both cervical hand- sewn esophagogastic anastomoses for esophageal cancer surgery.
• 13 patients with perioperative mortality (7 cases of transverse and 6 patients of oblique techniques),
• 3 patients were lost in follow up period.

201 patients were classified into two groups:
Group 1 patients were treated by using routine transverse hand-sewn cervical esophagogastric anastomotic technique for esophageal cancer surgery, and Group 2 patients were treated by oblique hand-sewn cervical anastomotic technique.

Operative techniques
Surgical approaches used in both techniques were transhiatal esophagectomy with gastric pull up interposition used as an esophageal substitute and jejunostomy feeding tube. High midabdominal and left cervical incisions were performed gastric releasing and after esophageal resection the stomach was delivered through thoracic inlet into the left cervical area. Cervical esophagus was cut obliquely in group 2 with two centimeter distance from left recurrent nerve insertion while in group 1 it was cut transversely with the same distance from the left recurrent nerve. The surface diameter of oblique hand- sewn anastomosis of esophagectomy in the neck reached to 4.5-5.5 cm whereas transverse anastomosis had a diameter of nearly 3 cm. Cut surfaces were measured by sterilized steel ruler. Details of techniques of cervical esophagogastric anastomosis in both groups are illustrated in Figure 1 and Figure 2. Both hand- sewn anastomosis groups were accomplished using an interrupted two layer suturing with 3-0 vicryl in inner layers and 3-0 silk sutures in outer layers.

Since September 2002 the new “Oblique hand-sewn technique started and results were compared with transverse technique regarding formation of anastomotic strictures. Diagnosis of benign anastomotic stricture was mad through complaint of dysphasia while solid, semisolid or fluid materials intake. The gold standard to assess and diagnose stricture formation was endoscopy in our study. The true strictures were dilated using rigid esophagoscope and gum tipped (Jackson woven) or Eder-Puestow dilators under sedation or general anesthesia, until a maximum diameter of 16-25 mm were achieved. In all of strictures, biopsies were also taken. Data were obtained from medical records and office records. Reflux symptoms, dysphagia, cervical anastomotic leak, strictures, second hospitalization for rigid esophagoscope, anastomotic dilation and prognosis were studied. Discharged patients were followed up in outpatient clinic one, two, four, six and twelve months after the surgery. Usually surgeons assessed outcome of the surgeries and they were not blinded regarding the operative technique. Barium swallow was not given routinely in patients with dysphagia and endoscopy was also not routinely performed on asymptomatic patients for determining the degree of reflux. Only patients suffering from recurrent dysphagia were investigated and hospitalized for performing rigid esophagoscope. Dilation was performed only if true strictures were present. Sometimes dilations were repeated if symptoms persisted.

Statistical analysis
The primary endpoint was comparison of postoperative dysphagia in two groups and benign stricture rates were the main end points of study. Data were expressed as Mean± SD & N (%). The Kolmogrov – Smirnov statistic was used for testing normality for continuous variables. Independent samples T test was used for continuous variables and Chi – square or Fisher exact test for nominal or ordinal variables. P-value less than 0.05 were considered statistically significant. The statistical package for social science (SPSS 15) was used for statistical analysis.

Results
The demographic data of 201 patients who underwent hand-sewn anastomosis are listed in Table 1. There were 57 (58.2%) males and 44 (41.8%) females in group 1, and 62 (60.2%) males, 41 (39.8%) females in group 2. Age distribution in group 1 were from 28 -81 years with a mean age of (60.84± 10.64), and in group 2, from 35 -80 years with a mean age of (60.10± 11.94) years. Results of two esophagogastric anastomosis groups of this study were compared as follows: There were no significant differences in the age, sex distribution, site of lesions, associated illness, pathologic types of tumor and staging between two groups (Table 1).

Both groups of our patients have low percent of serum albumin (64% in group 1 versus 69% in group 2), anemia (38% in group 1 versus 41% in group 2), and hypoproteinemia with weak nutritional status (47% in group 1 versus 52% in group 2). Mean percent of serum albumin changes in group 1 and 2 were 19.02± 5.35 and 21.85± 5.11. Hb level changes in group 1 and 2 were 11.45± 2.08 and 12.07 ± 2.12. Nutritional status of both groups was below normal. The mean operative
Table 1. Patients characters in two groups

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>60.84±10.64</td>
<td>60.10±11.94</td>
<td>0.64</td>
</tr>
<tr>
<td>Gender M/F</td>
<td>58/42</td>
<td>60/40</td>
<td>0.88</td>
</tr>
<tr>
<td>Site of lesion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper third</td>
<td>6(6)</td>
<td>7(7)</td>
<td>0.89</td>
</tr>
<tr>
<td>Middle third</td>
<td>44(44)</td>
<td>46(46)</td>
<td></td>
</tr>
<tr>
<td>Lower third</td>
<td>50(50)</td>
<td>47(47)</td>
<td></td>
</tr>
<tr>
<td>Associated illness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>9(9)</td>
<td>12(12)</td>
<td>0.58</td>
</tr>
<tr>
<td>Hypertension</td>
<td>19(19)</td>
<td>26(26)</td>
<td></td>
</tr>
<tr>
<td>Pathologic diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCC</td>
<td>83(83)</td>
<td>91(91)</td>
<td>0.14</td>
</tr>
<tr>
<td>ADC</td>
<td>17(17)</td>
<td>9(9)</td>
<td></td>
</tr>
<tr>
<td>Pathologic stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 0</td>
<td>0(0)</td>
<td>0(0)</td>
<td>0.13</td>
</tr>
<tr>
<td>Stage I</td>
<td>5(5)</td>
<td>2(2)</td>
<td></td>
</tr>
<tr>
<td>Stage II</td>
<td>37(37)</td>
<td>28(28)</td>
<td></td>
</tr>
<tr>
<td>Stage III</td>
<td>58(58)</td>
<td>70(70)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Postoperative complications and treatment in relation to anastomosis in two groups

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (n)</th>
<th>Group 2 (n)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative leakage</td>
<td>33</td>
<td>24</td>
<td>0.21</td>
</tr>
<tr>
<td>Reflux</td>
<td>15</td>
<td>17</td>
<td>0.84</td>
</tr>
<tr>
<td>Dysphagea</td>
<td>20</td>
<td>5</td>
<td>0.002</td>
</tr>
<tr>
<td>True stricture</td>
<td>16</td>
<td>3</td>
<td>0.003</td>
</tr>
<tr>
<td>Successful dilation</td>
<td>13</td>
<td>3</td>
<td>0.016</td>
</tr>
<tr>
<td>Strictureplasty</td>
<td>1</td>
<td>0</td>
<td>0.50</td>
</tr>
</tbody>
</table>

time of group 1 patients were 164.14 ± 34.95 (ranging 120-240 minutes) and of group 2 patients were 156.02 ± 39.32 (ranging 128 to 250 minutes) (P=0.124). Also there was no significant difference in the estimated blood loss between two groups (group 1, 640.12±210.57 ml vs. 610.42±180.14 ml of group 2, P=0.28). Analysis of the duration of hospital stay revealed no significant difference of anastomotic techniques of two groups (oblique hand sewn techniques versus transverse were: 12.25± 4.86 days versus 13.49±4.20 days; P=0.055).

Analysis of the postoperative esophagogastric anastomotic leak rate was shown 24 (23.3%) patients in group 1 versus 13 (13.26%) patients in group 2 (P=0.03). In general, anastomotic leak required hospitalization as following: a mean 17.08±2.79 days in group 1 compared to a mean of 16.46±3.86 days in group 2 (P=0.19). All leaks of both groups were managed successfully by cervical drainage, followed by jejunostomy feeding tube alimentations and antibiotics. In rare cases of empyema, closed chest tube drainage was added to treatment.

There were 32 patients (16%) who had symptomatic reflux after transhiatal esophagectomy (15 patients in group 1 and 17 patients in group 2) with (P= 0.84).

Dysphagia was found in 25 patients (12.5%), 20 patients in group 1 (20%), and 5 patients of group 2 (5%) during follow up period (P=0.002). After workup and during rigid esophagoscopy, 16 patients of group 1 and three patients of group 2 had true anastomotic strictures (P=0.003). Mean time of anastomotic strictures presentation was 4.30 ±0.24 month. After a minimum of two month follow up, the frequency of postoperative dilation between two groups were started (mean 3.5, ranging 1-6 month).

Comparison of anastomotic strictures, symptomatic reflux, dysphagia, true stricture during rigid esophagoscopy and response to dilations were shown in Table 2.

There was statistically significant difference between the incidence of anastomotic leak versus stricture formation in both groups (P=0.001).

Postoperative caring between two groups is not different. Treatment of anastomotic strictures is performed by dilation (2-5 times in both groups) and preserves satisfactory in group 2, but three patients of group 1, were not responding satisfactorily to dilation.

One patient of group 1 was treated by surgical stricturoplasty. After one year follow up period the results were not changed.

Figure 1. Oblique esophagogastric anastomosis after delivery of gastric graft through posterior mediastinum and thoracic outlet to cervical area.

Discussion

The incidence of anastomotic complications after cervical esophagogastric anastomosis is high. Using staplers helped to decrease intrathoracic esophagogastric anastomotic leak to below 5%, but similar results were not obtained with cervical anastomosis surgical technique is likely to play a major role in stricture formation. Even today, most of the surgeons consider hand sewing techniques to be superior to the mechanical technique for esophagogastric anastomosis. In one prospective
reported a marked decrease in the need for postoperative dilations and treatment of strictures (48% to 35%).
By using oblique interrupted hand sewn anastomosis, we made large cross-sectional area in the anastomotic surface and obvious drop in occurring postoperative strictures happened. The interrupted two layer hand-sown anastomotique technique method was used in both groups of our series. The operating time was not different between two groups.
Recurrent dysphagia after postoperative strictures usually responded to dilations. We did not perform early endoscopic dilation in cases of leakage and all of dilations performed after happening of dysphagia. Some surgeons add a proton pump inhibitor to the patient’s regimens to prevent recurrence dysphagia produced by exposure of acid and bile reflux.
The cervical esophagogastric anastomosis has higher leak rates than intrathoracic anastomosis; the incidence is about 10-25%. Our results may have mild high leakage rates especially in group 1. This can be explained by:
o Using gastric tube interposition in all cases. Gastric tube interposition has higher rate incidence in comparison with colonic interposition.
o The impact of malnutrition and hypoproteinemia that was common in our patients because of high grade stages of esophageal carcinomas at admissions.
o The impact of skill in performing esophagogastric anastomosis. Our center is a teaching hospital and near half of anastomosis was performed by residents.
The anastomotic technique has also the most significant bearing effect on stricture formation. In both groups tissue necrosis, inflammation and delayed epithelialization may predispose to excessive fibrosis and stricture formation. Dewar reported 31% strictures in his series. Anastomotic leak after transhiatal esophagectomy had an obvious impact on morbidity, mortality and subsequently for dilation. In Schuchert study on esophagectomy for esophageal cancer surgery, he showed 30(13%) anastomotic leak and greater morbidity and stricture formation (57% vs. 19%). Increasing leak was associated with an increased need for postoperative anastomotic dilations.
The incidence of anastomotic leakages and relation with true stricture formation in two groups of our study were shown in Table 2 (P=0.001).
Most patients with symptomatic anastomotic strictures following esophagectomy and cervical esophagogastrectomy present within few month after surgery. Dilation is safe and most symptomatic patients relieve with a few dilation.
Most patients of both groups in our series who developed strictures responded to 2 to 5 dilations. They usually needed at less than 6-month during follow up period.
Gupta had studied in one hundred patients with

randomized controlled clinical trial of Zhang’s study in 516 patients showed markedly decreased stricture formation in hand sewn patients. Conflicting reports exist regarding the superiority of hand sewn versus stapler sutures, but our purpose is not the comparison of hand sewn and mechanical stapled techniques.
Stricture formation is one of the known complications of esophageal cancer surgery. Numerous factors have been proposed in the etiology of anastomotic leak of benign anastomotic strictures. Therefore all the factors related to the incidence of anastomotic leaks may play a role in developing anastomotic strictures. Hypoalbuminemia, increased intraoperative blood loss, hypotension, hypoxemia are the known causes.
Both groups of our patients have low percent of serum albumin, anemia, and hypoproteinemia with low nutritional status because of advanced stages of esophageal carcinoma. Cardiovascular disease, gastric tube compared with colonic interposition and anastomotic leakage were also known causes for the development of benign cervical strictures.
Type of anastomosis is known to be the most important factors in occurring leak and postoperative strictures. Dysphagia following esophagectomy with cervical esophagogastric anastomosis is common and often can be attributed o anastomotic strictures. Comparing one layer anastomosis with two layer anastomosis revealed a slightly higher rate of leak in one layer anastomosis, but incidence of stricture formation was found to be lower. Two layer hand- sewn esophagogastric anastomosis have shown a slightly higher rate of strictures than one layer anastomotic technique. Circular end to end anastomosis has shown a higher rate of associated strictures.
By selecting end to side semi mechanical anastomosis and creation of large cross-sectional area, Orringer and colleagues
Esophagogastric anastomotic technique

resectable esophageal carcinoma that were randomly distributed into two groups of 50 each and treated by one stage transthiatal esophagectomy. In one group (3×2 cm) gastric crescent was excised from the anterior wall of the gastric tube before constructing cervical esophagogastric anastomosis and wide cross sectional area achieved in anastomotic site. His study showed less anastomotic complications and stricture formation in this group.45 Our study also gives a useful result that by creation of large cross-sectional area at the anastomotic site with oblique esophagogastric anastomosis an obvious decrease of strictures was obtained (3% in comparison with 16.3% of transverse esophagogastric anastomosis). In our study with acceptable resection margin rates, the recurrence rates were low for both techniques and also there was not any technical problem in doing oblique hand sewn anastomotic technique. We think by changing anastomotic techniques and creation of large cross-sectional anastomosis, the constant rate leaks could create fibrous formation but could not produce symptomatic strictures because of large diameter of anastomosis in oblique method. This study has some limitations as following:

• Single center, retrospective nature and the possibility of biases present in the selection criteria that might have influenced the results.
• Surgeon preference of method with retrospective nonrandomized clinical study.
• The oblique esophagogastric anastomotic technique has been discussed to have advantage in decreasing stricture formation in this study. However, further experimental validation is necessary.
• Our results, however may gain wider acceptability if verified through more exclusive studies with larger sample series to confirm our results.
• Median survival rate were not assessed in our study. Determination of formal survival rate analysis may be needed.

Conclusion

To reduce the benign stricture formation of esophagogastric anastomosis after esophageal cancer surgery, not only omitting anastomotic strictures leak causes are important, but also creation of wide cross-sectional area at anastomotic sites is also important. Hand sewn cervical esophagogastric anastomosis had priority in Kim’s meta-analysis study.33 This new hand sewn surgical technique is simple and may impact on decreasing the debilitating morbidity (dysphagia) in esophageal cancer patients.

Competing interests: The authors had no competing interests to declare in relation to this article.

References


Assessment of Mini-dose Succinylcholine Effect on Facilitating Laryngeal Mask Airway Insertion

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ABSTRACT

Introduction: Laryngeal Mask Airway (LMA) has gained wide acceptance for routine airway management and with increasing emphasis on day care surgery it is widely used. The aim of this study was to assess the effects of mini dose succinylcholine (0.1mg/kg) with semi-inflated cuff on facilitation of laryngeal mask airway insertion in order to achieve more satisfaction yet less complications. Methods: In a randomized double-blinded study, sixty ASA 1, 2 and 3 patients aged 20-60 years scheduled for urologic surgical procedures were included. Thirty patients received succinylcholine (Group S), and thirty received 0.9% sodium chloride as a placebo (Group C). Results: Coughing occurred in 33.3% of patients in the control group and there was no incidence in succ group (P=0.002). Head or limb movement occurred in 70% of the patients in the control group vs. 10% in succ group (P<0.001). Laryngospasm occurred in 36.6% of the patients in the control group but there was no incidence in succ group (P=0.004). Additional propofol was required in 53% of the patients in control group vs. 10% for succ group (P=0.001). Ease of insertion and first successful attempt of LMA were achieved in 93.3% and 90% of the patients respectively in group S (P<0.05). Myalgia and sore throat occurred in 66.7% of patients in the group C in comparison with 33.3% in group S (P=0.06). Conclusion: The combination of propofol with mini dose succinylcholine, provided a significantly better method for LMA insertion, while reduced propofol doses were needed and number of attempts decreased.

Introduction: Patient safety and acquiring skilled practice has always been of great importance for the physician of all eras. The laryngeal mask airway (LMA), being firstly introduced in 1983, fills the gap between the face mask and tracheal tube. It causes minimal disturbances in cardiovascular and respiratory systems. As outpatient surgery continues to grow over the world, the emphasis on day case anaesthesia is increased which in turns has led to increasing use of the laryngeal mask airway instead of face mask or tracheal tube. Some complications including gagging, coughing and laryngospasm may occur in response to inserting an LMA which may make correct positioning difficult or impossible. Although LMA is a popular device between anesthesiologists, an optimal induction technique to insert an LMA has not been defined. For most anesthesiologists, propofol is the agent of choice for LMA insertion as this agent best obtunds oropharyngeal reflexes. The standard dose of propofol (2-3 mg/kg) is accompanied by a higher failure rate; however, its use in doses which allow adequate jaw relaxation and prevent patient’s reaction to LMA insertion commonly results in hypotension and prolonged apnea as the drug’s side effects. A number of studies applied different induction methods and insertion techniques to find the best method for LMA insertion. Intravenous induction technique either with a single or two drugs is commonly used to insert an LMA. In the latter method, propofol is used with another anesthetic drug such as thiopentone or a volatile agent, a muscle relaxant and local anesthetia. Drugs commonly used as sedative premedications include benzodiazepines, opioids and lidocaine which blunt laryngeal reflexes and may be useful in facilitating LMA insertion. Since the duration of action of these drugs is rather long, their use in short term surgeries may be contraindicated. Use of low dose...
neuromuscular blocking drugs was firstly started by Dr. AIJ Brain which used a small dose of alcuronium (0.2mg kg-1) before LMA insertion and has continued till now. Later, some studies showed that relaxation was not essential for LMA insertion but the upper airway reflexes must be reduced for insertion to be successful.31

Materials and methods
We conducted a double-blinded randomized study to investigate ease of LMA insertion after the induction of anesthesia with propofol supplemented with mini-dose of succinylcholine. Approval was obtained from our local hospital research ethics committee. Informed written consent was obtained from participating patients. Then, we included sixty American Society of Anesthesiologists (ASA) 1, 2 and 3 patients of either sex, aged 20 to 60 years, scheduled for a day urologic procedures, lasting for not more than 1 hour.

Selection of the patients was made as per criteria excluding the confounding factors in order to make the valid conclusion. Patients with following conditions, were excluded from the study:

- previous history of malignant hyperthermia
- any anatomical abnormality of mouth, pharynx and larynx.
- risk of aspiration (History of gastroesophageal reflux or upper gastrointestinal surgery).
- full stomach (pregnancy, hiatal hernia).
- high airway resistance
- difficult airway
- low pulmonary compliance (severe obesity).
- previous history of hypersensitivity to any of study drugs.
- previous history of malignant hyperthermia

All patients were randomly allocated to one of the 2 groups, with 30 patients in each group. Group control (Group C) received a bolus dose of 2 ml of 0.9% sodium chloride I.V post induction. Study Group (Group S) received a bolus of succinylcholine 0.1 mg/kg diluted in 2 ml of 0.9% sodium chloride I.V post induction.

A uniform general anesthesia technique was applied in all patients.

Preoxygenation was performed for 3 minutes before induction and then premedication was performed with midazolam 0.01 mg/kg, and fentanyl 1µg/kg and induction was performed using propofol 2 mg/kg. Thirty seconds later patients received either 2 ml of 0.9% sodium chloride (control group) or a bolus dose of succinylcholine 0.1 mg/kg diluted in 2 ml of 0.9% sodium chloride (succinylcholine group). Thirty seconds after that, LMA was inserted by a blind investigator using a semi-inflated LMA technique, while assessing the condition during LMA insertion. Additional doses of propofol were given where conditions for LMA insertion were poor, or before second attempt.

If there were airway reflexes preventing LMA insertion, inability to ventilate after insertion of the LMA, or limb and head movement requiring restraint in the patient, another dose of propofol 0.5 mg/kg bolus was given, followed by another attempt at LMA insertion 30 seconds later. This cycle was repeated until the LMA was successfully inserted. The numbers of attempts were recorded, but ease of insertion was assessed only during the first attempt.

An investigator blinded to the patient group collected the following data: Demographic data: age, sex Incidence of cough and gagging, laryngospasm. Head and limbs movement was evaluated as follows31,32:

1. None
2. Mild
3. Moderate
4. Severe

Ease of Insertion of LMA and the overall insertion conditions were evaluated as following31,33:

1. Easy
2. Difficult
3. Impossible

Post operative myalgia and sore throat were evaluated as following31:

1. None
2. Mild
3. Moderate
4. Severe

The degree of myalgia was scored according to the severity from 1 to 4. Pain was assessed by a visual analogue self rating method.34

Results
The demographic data were comparable among the two groups in terms of age and gender ratio. There was no significant difference between the groups with respect to age and sex.

Gagging occurred in up to 23 (76.7%) of patients in group C of which it was mild in 10 patients, moderate in 10 patients and severe in 3 patients. This rate was 16.6% in group S of which it was mild in 4 patients and moderate in 1 patient. The difference among them was statistically significant (P<0.001).

Coughing occurred in up to 7 (33.3%) patients in group C of which it was mild in 7 patients and moderate in 3 patients. There was no incidence of coughing in group S and the difference was statistically significant (P=0.002).

Laryngospasm occurred in 11 (36.6%) patients of the control group of which it was mild in 6 patients, moderate in 4 patients and severe in 1 patient. There was no incidence of laryngospasm in succinylcholine group and the difference was statistically significant (P=0.004).

Head or limb movement occurred in 21 (70%) patients of group C of which it was mild in 7 patients, moderate in 10 patients and severe in 4 patients. This rate was...
Mini-dose Succinylcholine Effect on LMA

10% (3 patients) in group C and they all were mild in severity and the difference was statistically significant ($P<0.001$; Table 1).

The first attempt in LMA insertion was successful in up to 27 (90%) patients in group S whereas this rate was 46.6% (14 patients) in group C. LMA was successfully inserted in the second or further attempts 10% (3 patients) and 53.4% (16 patients) in succinylcholine and the control groups respectively. The difference was statistically significant ($P=0.001$).

The standard dose of propofol for induction of anesthesia was defined as $2\text{ mg/kg}$ and if there was a need to excess doses of propofol, bolus doses of $0.25\text{ mg/kg}$ was administered again.

Additional propofol was required in 53% of patients in group C, whereas this rate was 10% for group S, respectively (Table 1). The difference among them was statistically significant ($P=0.001$). Myalgia and sore throat occurred in (66.7%) patients of the control group of which it was mild in 12 patients and moderate in 8 patients. The incidence of myalgia and sore throat was 43.3% (13 patients) in group S of which it was mild in 12 patients and moderate in 1 patient. The difference was not statistically significant ($P=0.06$).

The first attempt to LMA insertion was successful in up to 90% (27 patients) in group S whereas this rate was 46.6% (14 patients) in group C. Success in insertion of LMA was achieved in second or more attempts of 3 (10%) patients of group S and 16 (53.4%) patients in group C. The difference was statistically significant ($P=0.001$; Table 2).

### Table 1. Demographic Data

<table>
<thead>
<tr>
<th>Group</th>
<th>Excess Propofol</th>
<th>No (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group control</td>
<td>Yes</td>
<td>16 (53.4)</td>
<td>3 (10)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>14 (46.6)</td>
<td>27 (90)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of attempts</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14 (46.6)</td>
</tr>
<tr>
<td>≥2</td>
<td>16 (53.4)</td>
</tr>
</tbody>
</table>

### Table 2. Postoperative Myalgia and sore throat

<table>
<thead>
<tr>
<th>Group</th>
<th>Myalgia and sore throat</th>
<th>No (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group control</td>
<td>No</td>
<td>10 (33.3)</td>
<td>17 (56.7)</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>20 (66.7)</td>
<td>13 (43.3)</td>
</tr>
</tbody>
</table>

Discussion

Since the introduction of the laryngeal mask airway, various methods have been evaluated in order to make its insertion smooth, with least side effects and cost effectiveness. The insertion of an LMA requires suppression of upper airway reflexes to prevent coughing, gagging or laryngospasm. Since propofol is the induction agent of choice for LMA insertion but propofol alone, in standard dose does not provide the best insertion conditions. The use of minidose of muscle relaxant provides a better insertion condition for propofol and thiotpentone as induction agent. Depolarizing muscle relaxants have a far better effect than non-depolarizing drugs. Succinylcholine is the only available depolarizing neuromuscular blocker. It is characterized by rapid onset of effect and ultrashort duration of action. Administration of 1 mg/kg of succinylcholine results in complete relaxation in 60 seconds and recovery requires 9-13 minutes. Probable side effects are prolonged apnea, anaphylaxia, and myalgia. Intubating dose of succinylcholine is 1-2 mg/kg and a very small dose of succinylcholine (0.1 mg/kg) is effective in relieving laryngospasm without prolonged apnea.

In our study ease of insertion of LMA and the excellent insertion conditions were obtained in 93.3% of patients in group S compared to 36.6% of group C ($P<0.001$). There was no incidence of head and limbs movement, coughing or laryngospasm in group S. Gagging was significantly less observed in the Group S compared to the Group C. Coughing, head and limbs movement and laryngospasm occurred less frequently in the Group S compared to the Group C. These findings are consistent with those by Korula et al. compared succinyl choline 0.35 mg/kg with 0.08 mg/kg of atracurium for LMA insertion during thiotpentone induction and they found that succinylcholine provided better insertion conditions as there was no coughing or gagging, and minimal patient movement. Monem and Chohan, comparing succinylcholine 0.35mg/kg with atracurium 0.06mg/kg under thiotpentone induction, found excellent insertion conditions with succinylcholine group in 83% as against 46% for that of atracurium. There was no failure in the succinylcholine group compared with 17% failure rate with atracurium.

We used the minimum dose of propofol (2 mg/kg) for the induction of anesthesia. If there were airway reflexes coughing, gagging, head or limb movement preventing LMA insertion, excess dose of propofol was needed, followed by another attempt at LMA insertion 30 seconds later. In our study, the overall amount of propofol used in the control group, was higher than succinylcholine group. Smooth LMA insertion using the defined propofol dose, was possible in only 46% of patients in the Group C and excess dose of propofol was needed in 53% of patients. The average propofol used was $206±50.2\text{ mg}$ in the control group and $162±21.3\text{ mg}$ in succinylcholine group. The difference was statistically significant ($P<0.001$).

Smooth LMA insertion with defined propofol dose, was possible in about 90% of patients in group S and excess dose of propofol was needed in only 9.9% of patients; these findings were consistent with those of Jamil et al. in which LMA insertion was easy with less swallowing, gagging or coughing in succinylcholine group. Less amounts of propofol ($2.05±0.07\text{ mg/kg}$ in respect to...
Postoperative sorethroat and myalgia was seen with a higher incidence in control group (66.7%) than succinylcholine group (33.3%) and the difference was not statistically significant. \(P=0.06\) Chui and Ho in a study reported a higher incidence of myalgia in control group than in succinylcholine group which was statistically significant. \(P=0.001\) . Similar results were achieved by Chae YK and coworkers. \(P=0.001\) .

In this study, as well as several other studies in this respect, the incidence of sore throat and myalgia was higher in the control group. The most likely reason for this lower incidence of sore throat and myalgia in the succinylcholine group may be due to reduced number of attempts and minimal manipulation of upper airway and pharynx.

**Conclusion**

Propofol as the onlyesthetic was not helpful in ease of insertion of LMA but in combination with mini dose succinylcholine, LMA was easily inserted. It seems that use of mini dose succinylcholine, reducing upper airway reflexes, is successful in ease of insertion of LMA and reducing propofol dose needed and a reduction in number of attempts. Reduced number of attempts was accompanied by less upper airway and pharynx manipulation resulting in a lower incidence of myalgia and sore throat.

**Competing interests:** The authors had no competing interests to declare in relation to this article.

**References**


Developing Indicators of Service Quality Provided for Cardiovascular Patients Hospitalized in Cardiac Care Unit

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Introduction
Cardiovascular diseases (CVD) are among the most prevalent chronic diseases leading to high degrees of mortality and morbidity worldwide and in Iran. The aim of the current study was to determine and develop appropriate indicators for evaluating provided service quality for cardiovascular patients admitted to Cardiac Care Units (CCU) in Iran. Methods: In order to determine the indicators for evaluating provided service quality, a four-stage process including reviewing systematic review articles in premier bibliographic databases, interview, performing two rounds of Delphi technique, and holding experts panel by attendance of experts in different fields was adopted. Finally, after recognizing relevant indicators in resources, these indicators were finalized during various stages using ideas of 27 experts in different fields. Results: Among 2800 found articles in the text reviewing phase, 21 articles, which had completely mentioned relevant indicators, were studied and 48 related indicators were extracted. After two interviews with a cardiologist and an epidemiologist, 32 items of the indicators were omitted and replaced by 27 indicators coping with the conditions of Iranian hospitals. Finally, 43 indicators were added into the Delphi phase and after 2 rounds of Delphi with 18 specialists, 7 cases were excluded due to their low scores of applicability. In the experts’ panel stage, 6 items were also omitted and 10 new indicators were developed to replace them. Eventually, 40 indicators were finalized. Conclusion: In this study, some proper indicators for evaluating provided service quality for CCU admissions in Iran were determined. Considering the informative richness of these indicators, they can be used by managers, policy makers, health service providers, and also insurance agencies in order to improve the quality of services, decisions, and policies.

Keywords: Indicator, Service Quality, Cardiac Care Unit, Cardiovascular Diseases, Delphi Technique

A B S T R A C T

Introduction: Cardiovascular diseases are among the most prevalent chronic diseases leading to high degrees of mortality and morbidity worldwide and in Iran. The aim of the current study was to determine and develop appropriate indicators for evaluating provided service quality for cardiovascular patients admitted to Cardiac Care Units (CCU) in Iran. Methods: In order to determine the indicators for evaluating provided service quality, a four-stage process including reviewing systematic review articles in premier bibliographic databases, interview, performing two rounds of Delphi technique, and holding experts panel by attendance of experts in different fields was adopted. Finally, after recognizing relevant indicators in resources, these indicators were finalized during various stages using ideas of 27 experts in different fields. Results: Among 2800 found articles in the text reviewing phase, 21 articles, which had completely mentioned relevant indicators, were studied and 48 related indicators were extracted. After two interviews with a cardiologist and an epidemiologist, 32 items of the indicators were omitted and replaced by 27 indicators coping with the conditions of Iranian hospitals. Finally, 43 indicators were added into the Delphi phase and after 2 rounds of Delphi with 18 specialists, 7 cases were excluded due to their low scores of applicability. In the experts’ panel stage, 6 items were also omitted and 10 new indicators were developed to replace them. Eventually, 40 indicators were finalized. Conclusion: In this study, some proper indicators for evaluating provided service quality for CCU admissions in Iran were determined. Considering the informative richness of these indicators, they can be used by managers, policy makers, health service providers, and also insurance agencies in order to improve the quality of services, decisions, and policies.
goal, many health care systems around the world are using “indicators” for measuring the quality of health care. There are many definitions for indicator in literature; Joint Commission Accreditation on Health care Organizations (JCAHO) defined indicators as “A valid and reliable quantitative process or outcome measure related to one or more dimensions of performance such as effectiveness and appropriateness and a statistical value that provides an indication of the condition or direction over time of an organization performance of specified outcome.” Quality of care can be defined as “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.” In many of the countries numerous studies have been conducted to design and implement indicators in their health care systems. 

In Iranian health care system, in spite of the previous studies carried out on selecting and developing indicators of clinical effectiveness, risk management, and patient safety provided many indicators, there are limited indicators to measure quality of care, specific in intensive care such as cardiac care while previous studies indicate that current standards used in the assessment of hospitals are not efficient. The aim of this study was to select more relevant quality indicators from published resources and to adapt or develop quality indicators for measuring cardiac care quality in CCU at the level of Iranian health care system.

Materials and methods
This study is a part of a larger study on selecting and developing clinical governance performance indicators for hospitals of East Azerbaijan – Iran which is in progress by Tabriz University of Medical Sciences clinical governance committee. Due to the importance and extent of cardiac care indicators, the committee decided to conduct this part of the study separately and specially. In this part of the study, various methods were used to select and develop proper indicators for evaluating provided service quality for cardiovascular patients.

Systematic review
In the first phase of this study a systematic review was conducted to identify and collect the indicators for cardiac care in published resources. In this systematic literature review, Pubmed, Science Direct, Ovid, Medline, Magiran, SID (Scientific Information Database), Irandoc database, and relevant websites (Australian Council of Healthcare Standards, Agency for Healthcare Research and Quality, Joint Commission, ...) were searched with key words of: cardiac care indicator*, quality indicator*, CCU performance indicator*, hospital performance indicator*, clinical effectiveness indicator*, clinical indicator* hospital accreditation indicator*, and cardiac care standard* to ensure that we searched strategies which cover the most relevant domains of cardiac care. A conceptual framework was developed consisting of the following aspects: primary prevention of cardiac disease, secondary prevention of cardiac disease, acute coronary syndromes, cardiac interventions (CI), percutaneous coronary (PC), coronary artery bypass grafting (CABG), congestive heart failure (CHF) and rehabilitation of cardiac disease, as well as the Persian equivalents for these keywords. Searched indicators in all articles and reports had been published in English and Persian from 1980 to 2012. Manual search was also conducted through the index listings and peer-reviewed medical journals. Additional search was conducted using Cochrane Collaboration and Evidence-Based Medicine. Eligibility criteria for selected relevance indicators included: indicators in hospitals. Adequate descriptive information was provided about the indicators. The results were extracted, summarized and reported in appropriate tables.

Interviews
After collecting and summarizing indicators from published resources, two interviews were conducted with a cardiologist and an epidemiologist. Interviews lasted for 90 minutes and several numbers of indicators were excluded and many indicators and other information were added.

Delphi survey
After collecting indicators from published resources and modulating by specialists’ comments, selected indicators were intended to Delphi survey phase. Delphi questionnaire contains 43 indicators and questions in the following fields: Indicators on secondary prevention of cardiac disease: 4 indicators Indicators on acute coronary syndromes: 4 indicators Indicators on cardiac interventions: 5 indicators Indicators on congestive heart failure (CHF): 3 indicators Indicators on mortality and morbidity: 2 indicators Indicators on length of stay: 2 indicators Indicators on provider of health care: 12 indicators Indicators on general information: 11 indicators Delphi questionnaire form was designed using an extensive literature review and experts’ comments based on RAND Corporation Delphi form (form 1). Questionnaires were sent to 10 cardiologists. Specialists rated each indicator individually on a scale of 1–9 regarding its “applicability” and “importance”. Median scores and cases of disagreement for two aspects of applicability and importance were calculated in the first round of Delphi for each indicator. Indicators which received scores of 7–9 were accepted, while indicators which received scores 4–6 entered the second phase of Delphi, and indicators which received scores of 1–3 were excluded from study. 

Experts’ Panel
After identifying related indicators from resources and modifying them according to conditions of Iran and evaluating them by two rounds of Delphi technique, an experts’ panel including specialists and beneficiary persons was formed in order to finalize indicators list and
to make decision about collecting methods for needed information of each indicator. Members of panel were 2 cardiologists, 1 methodology and statistics specialist, 1 epidemiologist, and 1 nurse.

Results
As a result of systematic literature review, 2800 articles were found from databases. After screening the titles, abstracts, and full-texts, 2779 articles were excluded due to non-relevance, duplication, poor accordance with the study aim, and not mentioning to indicators. Finally, 21 more relevant articles were included to the study. Through detailed reading of 21 articles a list of 48 potential indicators were obtained.

After identifying indicators two interviews were conducted in order to get more familiarity and remove ambiguities which resulted in exclusion of 32 indicators due to difference in services and facilities, social and economical conditions, and lack of information and replaced by 27 indicators in accordance to conditions of hospitals in Iran. Finally, 43 indicators entered the Delphi evaluating stage. At first, Delphi round questionnaires were sent to 10 cardiologists and by its consequence, 8 indicators entered the second Delphi phase because of acquiring low mean score of 4-7. In the second Delphi phase, questionnaires were also sent to 8 persons and only one indicator acquired score of more than 7 and remaining 7 indicators were excluded (Table 1).

All 7 above-mentioned indicators were excluded from the study due to low scores in “applicability”. After analyzing Delphi phase results, experts’ panel was formed consisting of cardiologists, CCU nurses, and epidemiologists resulting in omission of 6 available indicators and replacement of other 10 indicators. Also content and form of some indicators were modified and decisions were made about measurement method and other executive issues (Table 2).

Discussion
Development of preventive, therapeutic, and rehabilitative technologies had an important role in treatment and prevention of cardiovascular diseases. However, there is limited information available for measuring effectiveness of these items in decreasing mortality and burden of these diseases and there are differences between world countries in strategies on decreasing and controlling cardiovascular diseases. Quantitative information on patient management, outcomes, and diagnosis are required for better understanding of these differences. Nowadays, indicators of evaluating service quality provided to these patients in the level of health and medical systems in different countries are used for this objective. As the results of our search show, there is no proper scientific and practical action for developing and using indicators of measuring the quality of services provided to patients. In this study it was tried to develop and design indicators for evaluating provided service quality for cardiovascular patients in Iran using a four-stage process including reviewing systematic review articles in premier bibliographic databases, interview, performing two rounds of Delphi technique, and holding experts’ panel by attendance of experts in different fields. In most points of the world studies have been conducted using a combination of these methods in order to develop indicators, such as the study of Canadian Cardiovascular Outcomes Research Team (CCORT) who used reviewing the articles and two-phase Delphi to develop indicators for evaluating quality of provided services to cardiovascular patients. In another study in Canada, it has been tried to develop congestive heart failure (CHF) indicators using article reviews and two-phase Delphi and 29 indicators as well as five test indicators were recommended in total. The reason for higher number in selected indicators of present study could have resulted from indicators added in interviews due to different conditions of hospitals and provided services for cardiovascular patients in Iran. The first attempts to develop indicators were made in the US when RAND organization, department of cardiology, and American Heart Association developed indicators for measuring quality of provided services for cardiovascular patients. Later on, the project of improving quality of cardiovascular cares and Joint Commission on Accreditation of Healthcare Organizations (JCAHO) also tried to develop indicators for evaluating quality.

Form 1. Delphi survey questionnaire form

<table>
<thead>
<tr>
<th>Indicators on secondary prevention of coronary heart disease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title:</strong> Aspirin on discharge after acute MI</td>
</tr>
<tr>
<td><strong>Measure:</strong> those prescribed aspirin at discharge / discharged patients with AMI without aspirin contraindications</td>
</tr>
<tr>
<td>Your comment:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Applicability</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 8 7 6 5 4 3 2 1</td>
<td>9 8 7 6 5 4 3 2 1</td>
</tr>
</tbody>
</table>
Table 1. Excluded indictors in Delphi survey rounds

<table>
<thead>
<tr>
<th>Denominator</th>
<th>Numerator</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of unique individuals hospitalized with a primary diagnosis of AMI</td>
<td>number of deaths in any setting that occurred within 1 year of hospital admission for a primary (principal) diagnosis of AMI</td>
<td>1- One-year mortality following AMI</td>
</tr>
<tr>
<td>All non-maternal/non-neonatal discharges with procedure code for CABG in any field. Age 40 years and older</td>
<td>Number of deaths per 100 discharges with procedure code for CABG in any field. Age 40 years and older</td>
<td>2- CABG in-hospital mortality rate</td>
</tr>
<tr>
<td>Number of people who have been discharged from hospital who have had a CABG operation</td>
<td>number of people who have had a CABG operation who have died after 1 year of discharge of a CABG</td>
<td>3- One-year mortality rate following CABG</td>
</tr>
<tr>
<td>Number of unique individuals discharged following a CABG operation. Numerator: number of deaths in hospital in patients with PTCA</td>
<td>number of unique individuals undergoing CABG re-operations within 6 months of discharge Measure proposed by panel members</td>
<td>4- CABG re-operation within 6 months of discharge</td>
</tr>
<tr>
<td>Number of PTCA performed</td>
<td>number of unique individuals having a second PTCA performed within 30 days of discharge</td>
<td>5- Repeat PTCA within 30 days of discharge</td>
</tr>
<tr>
<td>-</td>
<td>Mean of cardiac specialist presence time in CCU per each patient in CCU</td>
<td>6- Cardiac specialists</td>
</tr>
<tr>
<td>-</td>
<td>Mean of cardiac specialist presence in hour in afternoon and night shifts</td>
<td>7- Cardiac specialist in afternoon and night shifts</td>
</tr>
</tbody>
</table>

Table 2. Some of Final Indicators to Measure the Quality of Services Provided to Patients in CCU Wards

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Numerator</th>
<th>Denominator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin prescription after acute MI on discharge</td>
<td>Patients prescribed aspirin at discharge</td>
<td>Patients discharged with AMI lacking aspirin contraindications</td>
</tr>
<tr>
<td>ACE inhibitor prescription at discharge after AMI</td>
<td>prescribed an ACE inhibitor at discharge</td>
<td>patients discharged with left ventricular systolic dysfunction and without ACE inhibitor contraindications</td>
</tr>
<tr>
<td>β-blocker prescription at discharge after AMI</td>
<td>Patients prescribed β-blockers at hospital discharge</td>
<td>discharged patients with AMI without β-blocker contraindications</td>
</tr>
<tr>
<td>Statin treatment after a cardiac event</td>
<td>Patients attending primary care with a history of statin prescription after a cardiac event</td>
<td>Patients attending primary care with a history of cardiac event</td>
</tr>
<tr>
<td>Thrombolytic timing for patients with AMI</td>
<td>The time in minutes from time of arrival at hospital to time of administration of the thrombolytic</td>
<td>confirmed AMI patients who received thrombolytic treatment and have had adequate documentation of the time of arrival and the time of starting the thrombolytic</td>
</tr>
<tr>
<td>Timing of emergent PTCA for patients with AMI</td>
<td>Minutes from arrival at the hospital until starting the PTCA</td>
<td>all patients with confirmed AMI receiving a PTCA within 12 hours after arrival at the hospital and having adequate documentation of the time of arrival and the time of the PTCA</td>
</tr>
<tr>
<td>Aspirin at admission to hospital for AMI</td>
<td>number of patients without aspirin contraindications</td>
<td>hospitalized AMI patients without aspirin contraindications</td>
</tr>
<tr>
<td>Same-day CABG surgery rate after PTCA</td>
<td>number of unique individuals who have had a CABG within 24 hours following a PTCA</td>
<td>number of unique individuals who have had a PTCA</td>
</tr>
<tr>
<td>Proportion of patients with CHF receiving ACE inhibitor on discharge</td>
<td>number of individual patients with a principal diagnosis of CHF (ICD-9 428, ICD-10 I50) who are prescribed an ACE inhibitor at discharge</td>
<td>number of individual patients discharged with a principal diagnosis of CHF</td>
</tr>
<tr>
<td>Rate of β-blocker prescription at hospital discharge for CHF</td>
<td>number of individual patients with a diagnosis of CHF (ICD-9 428, ICD-10 I50) who are prescribed a β-blocker at discharge</td>
<td>number of individual patients discharged with a diagnosis of CHF</td>
</tr>
<tr>
<td>CHF in-hospital mortality rate</td>
<td>number of deaths per 100 discharges with principal diagnosis code for CHF</td>
<td>number of discharges with principal diagnosis code for CHF, exclude discharges with cardiac procedure codes in any field</td>
</tr>
<tr>
<td>Length of stay for patients with heart failure</td>
<td>Median length of stay for heart failure patients</td>
<td></td>
</tr>
<tr>
<td>The ratio of monthly CCU admissions due to ACS, CHF and cardiac arrhythmias</td>
<td>Number of patients admitted due to ACS, CHF and cardiac arrhythmias per month</td>
<td>Total number of CCU admissions per month</td>
</tr>
</tbody>
</table>

and measuring them by available primary data. In their study, Ulla et al. introduced 17 indicators for measuring quality of provided services for cardiovascular patients in the level of Organization for Co-operation and Development in countries using the methods of systematic review, Delphi, and experts’ panel and mentioned that cardiovascular diseases had a high mortality rate and there were many differences in provided services for these patients between different countries. As a result, using indicators of evaluating quality of services is one of the most proper available strategies to decrease these differences and observe global standards. Based on claims of ULLA one of the strategies to improve the quality of services and decrease current differences is
using indicators of evaluating services’ quality. It can be a justification to the higher number of indicators in this study since provided services in Iran are distant from global standards in some aspects and this is a factor that due to the weakness of system, we should pay more attention to these aspects which have lower significance in high income countries. In another study in Canada using experts’ panel 15 indicators for evaluating provided service quality for cardiovascular patients were developed in hospital level and in the 4 domains similar to that of our study. Also in another study using experts’ panel and two phases of Delphi technique, it has been tried to develop indicators for evaluating the quality of provided services for patients with congestive heart failure. By investigating conducted studies mentioned above it is possible to conclude that designing and developing indicators is a process which is used in studies in a combined way. Three stages of systematic review, Delphi technique, and experts’ panel have the most usage in the process of developing indicators for evaluating the quality of services and in this study personal interview was added to these stages. Tu et al. suggested 38 indicators for evaluating service quality provided for patients suffering from heart attack. Although the number of indicators in these two studies is similar but in this study, indicators are designed for all cardiovascular patients hospitalized in CCU while in the study mentioned above, designed indicators are limited to heart attack patients. It should be mentioned that since there were no designed indicators for measuring the quality of provided services for cardiovascular patients, it seems that it is better to use general indicators. However, in the future when using these indicators would be more conventional, specific indicators should be designed and used for each specific domain of cardiovascular diseases.

In this study in spite of identifying some indicators from texts in the domain of primary cares, they were excluded due to lack of relevance between primary care system and hospitals and difficulty in evaluating of primary care services. However, much attention is paid to primary level cares and management of chronic diseases by patients themselves due to the studies conducted in most of the countries. Regarding to this point, in a study Fredrick et al. attempted to design indicators for evaluating primary care services using systematic review and conducting four-phase Delphi technique and finally introduced 31 indicators for evaluating primary preventive services provided for cardiovascular patients. Due to the importance of primary cares and their role in preventing and decreasing the burden of cardiovascular diseases and available potentials in the level of primary cares in Iran, it could be very useful to pay attention to indicators proper to these levels in Iran.

The main reason for omission and exclusion of some indicators in this study was their low applicability scores and of the most important problems which were mentioned in interviews and “Suggestions” parts of Delphi technique forms one can list the items of lack of a useful and comprehensive informative system, lack of co-operation by personnel and specialist physicians in particular, lack of proper and adequate facilities, high workload, shortage in human resources, and etc.

As it was mentioned, it is possible to point to main weaknesses of this study as lack of selecting relevant indicators in the field of primary cares due to lack of proper relationship between primary care system and hospitals which makes it difficult to evaluate these services. Despite all mentioned weaknesses for the first time in the country it was tried to develop and design indicators for evaluating service quality provided for cardiovascular patients using a complete combination of systematic review, interview, Delphi technique, experts’ panel and making benefits of ideas of different beneficiary groups and experts, and it could be used in health and medical system of Iran. However it seems necessary to conduct similar and more complete studies and also to develop specific indicators for each of different aspects of cardiovascular diseases.

**Conclusion**

Considering high prevalence of cardiovascular diseases in Iran and its costs and side effects on patient, patient’s family, and society, and also since results of the review study showed that quality of life in cardiovascular patients of Iran is not so acceptable, we need to provide cares with higher degrees of quality for these patients. In order to be sure about the quality of provided services for these patients, using indicators for evaluating the quality of provided service as a proper and effective strategy have attracted a great deal of attention in recent years in the most points of the world. Since this important fact has been ignored hitherto in Iran, in this study it was tried to design indicators proper to our country using a complete process including systematic review of articles, interview, Delphi technique, holding experts’ panel, and making advantage of the thoughts and ideas of specialists and experts of different fields. Finally 40 indicators were introduced for this objective which due to their informative richness could be used for improving the quality of services, decision makings, and policy makings, by managers, policy makers, health service providers, and even by insurance agencies.

**Competing interests:** The authors had no competing interests to declare in relation to this article.

**References**


Effect of Intravenous Hydrocortisone on Preventing Postoperative Sore Throat Followed by Laryngeal Mask Airway Use in patients Undergoing Urogenital Surgeries

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Abstract

Introduction: Postoperative sore throat is a common complication which can lead to discomfort after operation and delay in patients’ returning to normal daily activities. The present study was carried out to evaluate the influence of intravenous hydrocortisone on preventing postoperative sore throat followed by laryngeal mask airway use. Methods: Sixty patients who were scheduled to undergo urogenital surgery were divided into two groups. Five minutes before anesthesia induction, 100 mg of intravenous hydrocortisone or placebo with the same volume were given to the patients randomly. At the end of the operation and after LMAs were removed, patients were asked about having sore throat at hours 2, 4 and 24 after operation. Results: There were three and six cases of sore throat after operation in hydrocortisone and in placebo groups respectively which showed no significant statistical difference (P=0.472). No cases of moderate or severe pain were reported in any of the patients in both groups and no statistically significant difference was observed regarding pain severity in recovery, hours 2, 4 or 24 after operation. Conclusion: Based on the statistical data obtained from this research, administrating intravenous hydrocortisone five minutes before anesthesia induction has no effect on postoperative sore throat severity and degree in urogenital surgeries.

Introduction

Patient safety and acquiring skilled practice has always been of great importance for the physician of all eras.¹-²⁷ Post-operative complications can be derived from the anesthesia techniques used for the surgery, for instance, the back pain caused following spinal anesthesia or the surgical process solely.²⁸ Postoperative sore throat is a common complication in anesthesia which can cause discomfort after operation and delay in patients’ returning to normal daily activities. In the recent years, many studies have been carried out to determine the incidence of postoperative sore throat and to find a solution to prevent it.²⁹-³³ Sore throat incidence has been reported to be 14.4% to 50% after intubation and 5.8% to 34% after using LMAs. Airway management method is the most effective factor in the incidence of postoperative sore throat.³⁴ The relation between the types of the devices used for airway management in general anesthesia and a degree of laryngopharyngeal complications is well-understood. While using LMA, its filled cuff can produce enough pressure to reduce circulation in laryngeal mucosa and also cause laryngeal trauma leading to sore throat.³⁵ Corticosteroids are of immense anti-inflammatory effects regardless of the source of the inflammation i.e. infection, chemical or physical damage or immune deficiency³⁶; hence it was hypothesized that anti-inflammatory characteristics of hydrocortisone may prevent postoperative sore throat or decrease its severity. Therefore, in the present study we decided to determine the effect of the administration of intravenous hydrocortisone on the degree and severity of postoperative sore throat in patients undergoing general anesthesia using LMAs for urogenital surgeries. The objective of this research was to answer the question if preventive medication using hydrocortisone could prevent postoperative sore throat caused by LMAs cuff.

Materials and methods

In a double-blinded randomized clinical study conducted at Imam Reza Hospital of Tabriz University of Medical Sciences from September 2009 to March 2010, sixty adult patients having ASA Class I-II who were scheduled to undergo urogenital surgery were selected. Patients
having the following conditions were excluded from our study: Upper respiratory tract abnormalities or infection, sore throat, abdominal surgery, first unsuccessful LMA insertion, patients with full stomach, emergency conditions, pregnancy and smoking. Patients in both genders and in the age range of 20 to 60 were divided into two groups randomly. The patients in hydrocortisone group were given 100 mg (2 mL) of intravenous hydrocortisone five minutes before anesthesia induction. The patients in placebo group were given normal saline with the same volume, five minutes before anesthesia induction. All patients were given Midazolam IV 0.03 mg/kg as premedication 20 minutes before surgery. Routine monitoring including pulse oximetry, pulse rate, non-invasive blood pressure, EKG, and ETCO2 were performed for all patients equally. Anesthesia induction was performed using fentanyl 1-2 µg/kg and propofol 2.5-3.5 mg/kg. Appropriate LMA size was selected according to the instructions of the manufacturer based on body weight. LMA cuff was lubricated using saline after being deflated. LMA was inserted after loss of consciousness and later filled with appropriate volumes of air room according to the instructions of the manufacturer. For example: LMA#4 with 30 cc of room air for adults with normal sized bodies.37 LMA insertion success was confirmed by chest expansion and capnography; halothane (1-2%) and a blend of N2O 50% and oxygen and fentanyl 50 µg every 30 minutes were used for anesthesia maintenance. Hemodynamic status of the patients was continuously monitored (Sazegan Gostar, VISTA model) using systolic and diastolic blood pressure, pulse rate, pulse rate, respiratory rate and arterial blood oxygen saturation in both groups before and after induction, at the end of the operation and in recovery. At the end of the operation and after LMA was removed, patients were asked about sore throat in recovery and hours 2, 4 and 24 after surgery. Pain degree was measured using a four score rating scale by an anesthesiologist who was unaware of the type of the solution content administered before operation. The four score rating scale was as following: 0= lack of sore throat in response to the question, 1= pain only in response to the question without any behavioral sign (mild), 2= pain response to the question accompanied with behavioral sign or complaining about the pain without being asked (moderate), 3= intense verbal response or frowning (severe).38

**Statistical methods**

To compare the mean of the normal quantity variables t-test and to compare the abnormal variables Mann-Whitney test was used. Qualitative variables were compared in both groups using Fisher’s exact test. Repeated measure tests were used to determine normal data and Friedman test to determine abnormal data regarding study of the changes in blood pressure, pulse rate, respiratory rate and arterial blood oxygen saturation at four stages before and after induction, at the end of the surgery and in the recovery. *P* value less than 0.05 was considered significant in all tests. Analyses were performed using SPSS 15.

**Results**

In this study, there was no significant difference between the patients of both groups regarding gender, weight, age and physical status (ASA), operation and anesthesia duration, cuff volume and LMA size (Table 1).

**Table 1. Demographic characteristics**

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>Hydrocortisone group (n=30)</th>
<th>Placebo group (n=30)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>35.66±2.30*</td>
<td>34.33±1.49*</td>
<td>0.66</td>
</tr>
<tr>
<td>Sex (Male/Female)</td>
<td>29/1</td>
<td>29/1</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>74.30±2.25*</td>
<td>74.56±1.91*</td>
<td>0.92</td>
</tr>
<tr>
<td>ASA I</td>
<td>27</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>ASA II</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Operation duration(min)</td>
<td>32.02</td>
<td>29.48</td>
<td>0.48</td>
</tr>
<tr>
<td>Anesthesia duration(min)</td>
<td>31.53</td>
<td>21.47</td>
<td>0.64</td>
</tr>
<tr>
<td>LMA Size</td>
<td>31</td>
<td>30</td>
<td>0.64</td>
</tr>
<tr>
<td>Cuff volume(cc)</td>
<td>31</td>
<td>30</td>
<td>0.64</td>
</tr>
</tbody>
</table>

Hemodynamic status (blood pressure, pulse rate, respiratory rate and arterial blood oxygen saturation) was not constant at all stages before and after anesthesia induction, at the end of surgery and recovery in both groups (inside groups) and significant differences were observed inside each group; however, these changes were not significantly (Table 2).

**Table 2. The variables related to the hemodynamic status (before and after anesthesia induction, at the end of the surgery and recovery) in both groups**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Hydrocortisone group (n=30)</th>
<th>Placebo group (n=30)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP (before induction)</td>
<td>130.51±2.73*</td>
<td>131.43±2.27*</td>
<td>0.8</td>
</tr>
<tr>
<td>DBP (before induction)</td>
<td>79.43±2.35*</td>
<td>80.66±1.96*</td>
<td>0.68</td>
</tr>
<tr>
<td>PR (before induction)</td>
<td>79.06±1.86*</td>
<td>80.43±1.78*</td>
<td>0.5</td>
</tr>
<tr>
<td>RR (before induction)</td>
<td>29.55</td>
<td>31.45</td>
<td>0.66</td>
</tr>
<tr>
<td>SaO2 (before induction)</td>
<td>30.4</td>
<td>30.6</td>
<td>0.94</td>
</tr>
<tr>
<td>SBP (after induction)</td>
<td>110.45±1.33*</td>
<td>117.13±2.77*</td>
<td>0.7</td>
</tr>
<tr>
<td>DBP (after induction)</td>
<td>72.53±2.19*</td>
<td>74.50±2.58*</td>
<td>0.59</td>
</tr>
<tr>
<td>PR (after induction)</td>
<td>80.22±1.7*</td>
<td>81.12±1.90*</td>
<td>0.62</td>
</tr>
<tr>
<td>RR (after induction)</td>
<td>32</td>
<td>29</td>
<td>0.48</td>
</tr>
<tr>
<td>SaO2 (after induction)</td>
<td>30.58</td>
<td>30.42</td>
<td>0.96</td>
</tr>
<tr>
<td>SBP (end of surgery)</td>
<td>115.40±2.08*</td>
<td>116.63±1.85*</td>
<td>0.65</td>
</tr>
<tr>
<td>DBP (end of surgery)</td>
<td>73.03±2.03*</td>
<td>73.76±2.24*</td>
<td>0.82</td>
</tr>
<tr>
<td>PR (end of surgery)</td>
<td>76.16±2.29*</td>
<td>75.50±1.81*</td>
<td>0.82</td>
</tr>
<tr>
<td>RR (end of surgery)</td>
<td>31.75</td>
<td>29.25</td>
<td>0.53</td>
</tr>
<tr>
<td>SaO2 (end of surgery)</td>
<td>30.52</td>
<td>30.48</td>
<td>0.99</td>
</tr>
<tr>
<td>SBP (recovery)</td>
<td>123.80±3.10*</td>
<td>125.03±2.52*</td>
<td>0.75</td>
</tr>
<tr>
<td>DBP (recovery)</td>
<td>79.56±2.65*</td>
<td>80.53±2.12*</td>
<td>0.7</td>
</tr>
<tr>
<td>PR (recovery)</td>
<td>78.00±2.90*</td>
<td>77.06±2.30*</td>
<td>0.8</td>
</tr>
<tr>
<td>RR (recovery)</td>
<td>31.08</td>
<td>29.92</td>
<td>0.74</td>
</tr>
<tr>
<td>SaO2 (recovery)</td>
<td>28.88</td>
<td>32.12</td>
<td></td>
</tr>
</tbody>
</table>

* Mean ±SD
In this study, sore throat complaint was observed in three cases (10%) of hydrocortisone group and six cases (20%) of placebo group; the difference between two groups was not statistically significant ($P=0.472$). These values are in accordance with the existing data from numerous studies. Regarding pain degree, no case of moderate or severe pain was reported in both groups during the study, all the existing complaints were of mild sore throat which could have been due to the short time of surgery and anesthesia in the present study.

Overall, there was no statistically significant difference between two groups regarding pain degree at the stages of recovery and hours 2, 4 and 24 after surgery (Table 3).

**Table 3. Sore throat, pain degree in recovery 2, 4 and 24 hours after operation**

<table>
<thead>
<tr>
<th></th>
<th>Hydrocortisone group(n=30)</th>
<th>Placebo group(n=30)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sore throat</td>
<td>3(10%)</td>
<td>6(20%)</td>
<td>0.472</td>
</tr>
<tr>
<td>In recovery</td>
<td>3.3%</td>
<td>13.3%</td>
<td>0.35</td>
</tr>
<tr>
<td>2 hours later</td>
<td>10%</td>
<td>13.3%</td>
<td>1</td>
</tr>
<tr>
<td>4 hours later</td>
<td>6.7%</td>
<td>6.7%</td>
<td>1</td>
</tr>
<tr>
<td>24 hours later</td>
<td>3.3%</td>
<td>10%</td>
<td>0.61</td>
</tr>
</tbody>
</table>

**Discussion**

Sore throat is considered a common complication after operation which can be caused due to numerous factors.39 Announced reports are suggestive of the fact that sore throat incidence varies in different studies due to the methods of airway management.40,41 The relation between devices used for airway management in general anesthesia and incidence and severity of laryngopharyngeal complications are well-understood and studied. Filled LMA cuff can impair mucosal blood circulation by its pressure leading to direct laryngeal trauma and sore throat which have also been reported in case of tracheal tubes.41 On the other hand, in another study, it has been concluded that the differences between the cuff pressures in LMA have no effect on laryngopharyngeal complications severity (dysphagia, hoarseness and sore throat).42 In recent years, numerous studies have been carried out to determine postoperative sore throat incident seeking a solution to prevent it.40 Post operative sore throat incidence has been reported to be 14.4% -50% after tracheal intubation and 5.8% -34% after LMA insertion.43-45 Similar to tracheal intubation, the incidence reported for sore throat after LMA insertion is varied which may be due to existing differences in expertise and insertion techniques, administration of lubricants and cuff pressure.43 In a study carried out on outpatient cases in which LMAs and tracheal tubes were used, post operative sore throat incidences were compared. This study revealed that post operative sore throat incidence decreased significantly from 45% to 34% using LMA.44 Mchardy et al. conducted a study which revealed that method of asking questions from the patients is a key factor in post operative sore throat incidence. 2 patients from 129 patients had a complaint of sore throat after indirect questioning whereas after direct questioning 28 patients from 113 patients complained about sore throat. This difference could be suggestive of the fact that patients usually pay attention to the signs directly related to their main problem i.e. surgery, not to the signs like sore throat which do not appear instantly after anesthesia or surgery.39 The obtained data from our study regarding sore throat incidence are in accordance with the existing articles. The existing difference may be due to the differences in expertise and techniques between anesthesiologists and or the definitions of sore throat in each anesthesiologist and patient’s mind. Therefore, airway management technique is important and essential and appropriate LMA and tracheal tube sizes should be selected for each patient. The efficacy of lubricants containing local anesthetics and their being helpful or harmful regarding sore throat after operation have not been thoroughly studied.39 Keller et al., in a study carried out on 120 patients undergoing general anesthesia using LMA, concluded that lubricating LMA with topical Lidocaine 2% did not reduce post operative sore throat incidence compared to lubricating with normal saline.46 To the best of our knowledge, no study has been conducted to approve the usage of topical anesthetic gel in lubricating tracheal tube decreasing post operative sore throat incidence.39 Surprisingly, in a study, using Lidocaine spray before intubation increased postoperative sore throat incidence37; in addition, in another study, lubricating tracheal tube using hydrocortisone gel 1% also increased postoperative sore throat incidence from 50% to 90%.48 Park et al., in a study carried out on 166 patients, showed that administering dexamethasone (0.2mg/kg IV) prior to operation reduced postoperative sore throat incidence in the patients undergone general anesthesia using double-lumen endobronchial tube.49

**Conclusion**

Based on the results obtained from the present study, it could be concluded that intravenous administration of hydrocortisone five minutes prior to anesthesia induction has no effect on degree or severity of post operative sore throat after using LMA in urogenital surgeries. Therefore, it is suggested that in future studies, considering larger statistical sample volumes and longer surgeries, effect of hydrocortisone, solely or in association with other medications, on post operative sore throat incidence is important and essential and appropriate LMA and tracheal tube sizes should be selected for each patient. The efficacy of lubricants containing local anesthetics and their being helpful or harmful regarding sore throat after operation have not been thoroughly studied.39 Keller et al., in a study carried out on 120 patients undergoing general anesthesia using LMA, concluded that lubricating LMA with topical Lidocaine 2% did not reduce post operative sore throat incidence compared to lubricating with normal saline.46 To the best of our knowledge, no study has been conducted to approve the usage of topical anesthetic gel in lubricating tracheal tube decreasing post operative sore throat incidence.39 Surprisingly, in a study, using Lidocaine spray before intubation increased postoperative sore throat incidence37; in addition, in another study, lubricating tracheal tube using hydrocortisone gel 1% also increased postoperative sore throat incidence from 50% to 90%.48 Park et al., in a study carried out on 166 patients, showed that administering dexamethasone (0.2mg/kg IV) prior to operation reduced postoperative sore throat incidence in the patients undergone general anesthesia using double-lumen endobronchial tube.49

**Competing interests:** The authors had no competing interests to declare in relation to this article.

**References**

Management of the Congenital Aneurysm of the Left Ventricle Associated with Mitral Insufficiency in a Child: A Case Report

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**Abstract**

The combination of congenital left ventricular aneurysm associated with mitral insufficiency is rare. We describe the case of a girl aged 11 years, bearing these two entities simultaneously. Aneurysmal resection of the left ventricle was performed with Dor technic to allow remodeling of the anatomy of the left ventricle. Mitral annuloplasty was performed through a transseptal approach. Three months after surgery, the child presents a good myocardial contractility without mitral regurgitation and normal ejection fraction.

**Introduction**

Congenital aneurysms of the left ventricle are uncommon entities. The largest series of these kinds of aneurysms that we found in the literature is 6 cases over a period of 11 years, described by Eloi Marijon et al. in 2006.\(^1\) In addition, many cases of ventricular aneurysms have been described in children and from post-traumatic stress disorder. The first case was successfully treated by Green and colleagues in 1965.\(^2\) The post-traumatic aneurysms appear days or weeks after thoracic trauma; while initial cardiac examination is generally negative or a simple contusion of the ventricular wall can be observed.\(^3\)\(^-\)\(^5\)

True congenital aneurysm of the left ventricle is usually associated with other birth malformations such as ventricular diverticula, septal defect, malformation of the thoraco-abdominal aorta and other complications; however, it can also be alone.\(^1\) The congenital aneurysms can be symptomatic or not symptomatic. Some authors such as Okeene and colleagues, to prevent possible complications, recommend systematical surgical treatment in all cases after diagnosis.\(^6\)

**Clinical case**

We present a 11 year old girl, without medical past history, which was taken to the hospital with her parents for a progressively worsening dyspnea. Clinical examination did not reveal any signs of right heart failure; only a systolic murmur in mitral focus could be auscultated. Chest X-ray showed a heart sabot with a cardiothoracic index of V2; however, the pulmonary vasculature appeared normal. Echocardiography revealed a dilated left ventricle with an acceptable ejection fraction associated with left ventricle aneurysm of the apical region (Figure 1). Mitral valve was associated with a moderate insufficiency. Chest MRI confirmed a large aneurysm supplied by a wide collar. We found a protuberant aneurysm (Figure 2), and his aneurysmal sac was opened longitudinally, the collar was reduced and fixed with Dacron patch at the junction with the healthy area of the endocardium using a DOR technique and the mitral annuloplasty was performed through the cross-septal approach.

**Discussion**

There are two groups of left ventricular aneurysms in children, the first group concerns acquired aneurysms (traumatic) and the second is the congenital aneurysms which have not been sufficiently described in the literature.\(^1\)\(^,\)\(^6\)

Congenital aneurysm of the left ventricle may appear as an isolated malformation or associated with other congenital anomalies. It is important to distinguish the congenital aneurysm and a congenital diverticulum of the left ventricle as these two entities may be confusing. Papagiannis and colleagues identified congenital aneurysms as the saccular expansions of the ventricular wall, with a wide collar, communicating with the ventricular cavity. However, diverticula are elongated and have a narrowed neck.\(^7\)

Generally postoperative course of diverticula seems...
simpler than the ventricular aneurysm. All authors agree with the surgical treatment when the aneurysm is symptomatic; however, controversy exists regarding the asymptomatic aneurysms. Some authors such as Okeene recommend a systematic resection to prevent complications such as thrombosis, rupture of the aneurysm, and left ventricular failure while other authors such as Eloi and colleagues do not recommend routine resection due to the elevated mortality.

In our case, we performed a median sternotomy and found a large aneurysm of the apical region of the left ventricle associated with significant mitral regurgitation. Resection was performed under cardiopulmonary bypass with aortic clamping. The surgical technic was that of DOR (longitudinal opening of the aneurysmal wall, closing collar with a Dacron patch to reshape a ventricular anatomy and in the end we sutured the walls of the aneurysm above the patch). Mitral annuloplasty was performed through a trans-septal approach. Histological examination of the aneurysmal wall revealed a non-specific fibrosis. The patient was examined three months later. She was completely asymptomatic, and echocardiography showed normal cardiac contractility with Dacron patch in place (Figure 3).

In 2009, Jamshidi and colleagues reported good results in the treatment of ventricular aneurysm, in a 23-month-old girl with immunodeficiency syndrome using the same technic of DOR.

**Conclusion**

Symptomatic congenital aneurysms of the left ventricle must be resected routinely. Dor seems to be the best technic to remodel the left ventricular anatomy. Aneurysms should not be allowed to evolve as they accelerate the development of mitral insufficiency which in turn leads to left ventricular dysfunction.

**Competing interests:** The authors declare that they have no competing interests, and did not receive funding for this article.

**References**

Progressive Paraparesis after CABG Surgery

Kamran Shadvar*, Yashar Eslampoor
Cardiovascular Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

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Article History:
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Paraparesis
CABG

ABSTRACT
CABG is one of the most common cardiac surgeries all over the world. Similar to other surgeries, it may be associated with some undesirable complications including neurologic complications which might cause morbidity and mortality after surgery. We will describe a case of Progressive Paraparesis after CABG Surgery and review its etiology, diagnosis and management.

Case history
A 73-year-old man with a history of chest pain 1.5 months was admitted to Shahid Madani heart hospital. He had hypertension and herniorrhaphy in his past medical history with no history of sensory or motor impairments. All lab data were within normal limits except for ESR (521st, 1132nd) & CRP (2+). Echocardiographic findings were LVEF of 55% and mild left ventricular hypertrophy. Coronary artery CT-angiography was performed and stenosis of three coronary arteries was established. The patient was scheduled for coronary artery bypass surgery (CABG). The induction of anesthesia was performed with Fentanyl 500 micrograms, midazolam 10 mg & cisatracurium 20 mg; later, anesthesia was maintained and maintained with infusion of fentanyl 4 μg/kg/hr , midazolam 1 μg/kg/min & cisatracurium 1 μg/kg/min. After positioning the patient with inserting a pillow in the back of his thoracic space (for better exposure of surgical field), The CABG surgery was performed with off pump coronary artery bypass (OPCAB) technique. The vital signs were stable during surgery and the ABGs during surgery were within normal limits. At the end of surgery the patient was transmitted to the ICU while being intubated and unconscious with BP=110/60 mmHg, HR=77/min and NSR, CVP=8 cmH$_2$O and SPO2=100%.

After admission to the ICU, the primary vital signs were normal except for BP. Nitroglycerine infusion was started because of high BP and tapered following the management of high BP. The patient was successfully weaned and extubated the day of surgery. The post-surgery drug orders were: Enoxaparin 40 mg q 12h/Sc, Osvix tab daily captopril 25 mg q12h, metoral 25 mg q12h, atorvastatine 40mg daily and ASA 80 mg daily.

The first day post-surgery, LAB findings in ICU were: Hb=10, Hct=30.5, Plt=242000, WBC=9100, PT=15.3, PTT=32, INR=1.47, Na=139, K=4.9, BUN=17, Cr=0.94, CPK=847, CK-MB=58. All of the following lab findings during ICU admission were within normal limits.

In the first day of admission, the patient was stable, awake and oriented. No signs of hemodynamic instability or cardiac dysrhythmias were seen. The patient just complained of dizziness and instability in walking. Neurologic consultation was performed stating that the cranial nerves were intact, cerebellar tests and sensory examinations were normal, muscle forces of lower limbs were 4/5 and symmetric and plantar reflexes were double flexor.

In the second day of admission, the overall condition of patient was good but the difficulty in complete movement of lower limbs was presented and he could not walk without aid. After that the progressive paraparesis appeared and the muscle forces and DTRs began to decrease gradually. For determination of cause of paraparesis with the probability of CVA or lacunar infarct in the internal capsule region diffusion-weighted MR Imaging of the Brain was obtained, but no abnormality was found (Figure 1). In the third day of admission, the paraparesis progressed and muscle forces decreased from 4/5 to 3/5 and then to 2/5. Neurology consultation was performed again recommending to rule out the vascular causes (due to slight coldness of the lower limbs, especially in the right lower limb). Color Doppler of lower limbs was performed and there was no stenosis or thrombosis in arteries or veins of the lower limbs (just a 9×36 mm baker cyst was seen at right popliteal region). In the fourth day of admission, severe weakness of lower limbs, absence of DTRs, no plantar reflexes, and muscle forces= 1/5 at left and 0/5 at right were observed but the sensation of...
the lower limbs was intact with ability to localization. Suspecting neuropathies, EMG-NCV was performed reporting peripheral sensory-motor polyneuropathy mainly demyelinating types with differential diagnosis of acute inflammatory demyelinating polyneuropathy (AIDP) and critical illness polyneuropathy (CIP). Neurology consultation was performed and after review of EMG-NCV reports they consider Guillain-Barre Polyneuropathy; however, they found a sensory level at T9-T10. It should be emphasized that due to this sensory level and after consulting with neurologist, thoracolumbosacral MRI was considered because spinal cord ischemia was at top of the list of differential diagnoses. Thoracolumbosacral MRI showed the pathologic fracture of the third thoracic vertebra with a compression in spinal cord (Figures 2 & 3). After diagnosis was made, an urgent consultation was performed with the neurosurgery service and the emergency spinal surgery was performed. The pathology of vertebral fracture was an extraludal mass; the definite site was unknown and metastatic adenocarcinoma was probable. In the follow-up period after spinal surgery, there was no change in patient weakness and after that because our patient had been discharged from the hospital we could not follow up the patient completely to discover if the weakness had been better or not.

Risk factors for neurologic complications in cardiac surgery are hemodynamic instability, diabetes mellitus, advanced age, complex procedures, prolonged CPB (>2hr), previous stroke, hypertension, hyperglycemia, hyperthermia, hypoxemia, aortic atheromatosis and peripheral vascular disease.1,2,5

Mechanisms and factors for neurologic lesions are embolization, hypoperfusion, influencing factors, aortic antheroma plaque, cerebrovascular disease, altered cerebral autoregulation, hypotension, intracardiac debris air, venous obstruction on bypass, CPB circuit surface, cerebral hyperthermia and hypoxia.

In this case, Our differential diagnoses were CV A or lacunar infarct (internal capsular region) - embolic or hemorrhagic, spinal cord ischemia and infarct (due to embolic insult or hypoperfusion), acute inflammatory demyelinating polyradiculoneuropathy (AIDP) or critically ill polyneuropathy (CIP), peripheral nervous injury, peripheral vascular disease and spinal cord ischemia.

In the Spinal cord ischemic stroke, neurologic deficits may occur without pain; however, most of them (>80%) are painful and this is an interesting difference from cerebral infarction which is usually not painful. Depending on the level of the cord lesion, symptoms may vary from mild to moderate and even from reversible leg weakness to quadriplegia. Fever is a warning (red flag)
to consider infectious origins particularly acute bacterial meningitis. It can occur because of surgical procedures in which hypotension and prolonged positioning (e.g. seated neurosurgical approaches and hyperlordosis) may be prominent factors.10-13 Involvement of intrinsic cord vessels has been reported with arteritis such as SLE. Anterior spinal artery occlusion has been reported with arteritis including that associated with syphilis and diabetes mellitus; after trauma; and as a complication of spinal angiography, spinal adhesive arachnoiditis, administration of intrathecal phenol, and spinal anesthesia. Aortic diseases are blamed to produce spinal infarction in a variety of situations including dissecting aneurysm; aortic surgery, especially with aortic cross-clamping above the renal artery aortography; atherosclerotic embolization; and aortic thrombosis. Uncommon causes include complications of abdominal surgery, particularly sympathectomy; circulatory failure as a result of cardiac arrest or prolonged hypotension; and vascular steal in the presence of an arteriovenous malformation, or vascular compression by tumors in the spinal canal, vertebral fracture, or a herniated intervertebral disk (Figure 2 & 3).12,13 This complication is a rare condition which is never discussed in the literature. We considered that this complication was due to a vertebral degenerative process in this patient and after placing role under the shoulder and positioning for thoracotomy, the T3 vertebral body was fractured. Despite occurrence of this complication, placing role to position for CABG surgery is inevitable and pathologies in vertebrae before surgery cannot be considered in all patient especially when the patient him/herself does not have any associated complaint. Hence, in this patient diagnosed was made accidentally.

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References