ASSESSMENT OF ANATOMICAL & FUNCTIONAL SUCCESS IN EXTERNAL DACRYOCYSTORHINOSTOMY BY AIR BUBBLE TEST

Dr. Vikas Tantuway¹ (Senior Resident), Dr. Priyanka Kolhe Nema² (Asst. Prof.), Dr. Vimlesh Choyal³ (PG resident 3rd year), Dr. Yashaswi Goynka⁴ (PG resident 2nd year) & Dr. Pushpa Varma⁵ (Prof and Head of Dept.)
Department of Ophthalmology, Index Medical College Hospital & Research Centre Indore¹,²,³,⁴,⁵

Article Info: Received 28 August 2019; Accepted 14 September 2019
DOI: https://doi.org/10.32553/ijmbs.v3i9.535
Corresponding author: Dr. Priyanka Kolhe Nema
Conflict of interest: No conflict of interest.

Abstract
Aim: To assess reliability indices of Air Bubble Test (ABT) for anatomical and functional success in external Dacryocystorhinostomy (DCR).

Methods: Prospective case series of nasolacrimal duct obstruction underwent DCR. Functional success defined as Munk score 0 & 1 & anatomical success as free irrigation at followup. ABT performed by putting antibiotic drops into eye & asking patient to exhale while keeping nose & mouth closed. Formation of bubbles at punctum considered as positive test. Specificity, sensitivity, positive & negative predictive values calculated.

Results: There were 103 DCR in 97 patients(23 male, 74 female) with mean age 45.56 yr. Anatomical and functional success was 99.02% & 98.05%, respectively. ABT showed sensitivity 96.07%, specificity 100% for anatomical success after DCR. Sensitivity and specificity were 97.02% & 100% for functional success.

Conclusion: As non-invasive procedure ABT is a good tool to assess success of DCR, though lacrimal syringing remains the gold standard.

Keywords: Anatomical, Dacryocystorhinostomy & Air Bubble Test.

INTRODUCTION

Tearing due to nasolacrimal duct obstruction (NLDO) could be addressed by dacryocystorhinostomy (DCR) procedure, which is performed either through external incision (Ext-DCR) or endonasal approach.¹,² Ext-DCR has remained the gold standard in the treatment of acquired NLDO.¹,³,⁴ Success of DCR procedure is generally defined based on both anatomical and functional success rates. Functional success is assessed according to patient symptom. Although lacrimal syringing is the gold standard test for assessing the anatomical success after DCR procedure,⁵ because a metallic probe is introduced into the lacrimal system, it can potentially cause puncto-canalicular damage.⁶ Furthermore, the authors and others have observed discomfort⁷ and sometimes even pain during irrigation test so that it, at times, was not possible to perform this test.

Air bubble test (ABT) was originally introduced in the name of valsalva air bubble test⁸ in 1992. It was then used as a test for lacrimal patency after Ext-DCR procedure in 1994,⁹ although the term of valsalva was subsequently questioned with regard to having open glottis during its test.¹⁰ Its incidence, in the name of air reflux, was assessed after external¹¹ and endonasal¹² DCR. However, to the best of the authors’ knowledge, its reliability indices (sensitivity, specificity, and positive and negative predictive values) have been reported only once in the literature.¹⁵

The aim of this study was to assess sensitivity, specificity, and positive and negative predictive values of ABT for both anatomical and functional success after an Ext-DCR.

METHODS

This is a prospective case series of patients with NLDO who had Ext-DCR procedure from October 2016 to April 2019. Overall functional success was defined as Munk score 0 & 1 and anatomical success as patent on irrigation at last follow-up visit.

Air bubble test was performed by asking the subjects to hold the nostrils firmly (supine position) and exhale forcibly against the closed mouth while putting a few drops of a topical antibiotic (ciprofloxacin 0.3%) on the eye at last follow-up visit.
Passage of air from nose to the eye (bubbles in the eye and or hissing noise) was considered as positive ABT. It took less than a minute and was not associated with any pain and or discomfort.

After ABT lacrimal syringing test was performed.

RESULTS

There were 103 Ext-DCR procedures in 97 patients (74 females, 23 males) with a mean age of 45.56 years (SD=; range, ) and follow up of 124.67 days (SD=; range, ). Anatomical and functional success was 99.02% (102/103) and 98.05% (101/103), respectively.

ABT was positive in 95.14% (98/103) of cases. One case with anatomical failure and 2 cases with functional failure had a negative ABT. It showed a sensitivity of 96.07% and specificity of 100% for the anatomical success in this series (Table 1). Its sensitivity and specificity for the functional success were 97.02% and 100%, respectively (Table 2).

Table 1: Sensitivity, specificity, and positive and negative PVs of ABT for anatomical success

<table>
<thead>
<tr>
<th></th>
<th>Success(syringing +)</th>
<th>Failure(syringing -)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air bubble test</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>98</td>
<td>0</td>
<td>98</td>
</tr>
<tr>
<td>Sensitivity: 96.07%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+PV: 100 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Specificity: 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-PV: 20%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>102</td>
<td>1</td>
<td>103</td>
</tr>
</tbody>
</table>

ABT, air bubble test; PV, predictive value

Table 2: Sensitivity, specificity, positive and negative PVs of ABT for overall functional success

<table>
<thead>
<tr>
<th></th>
<th>Success(munk score 0 and 1)</th>
<th>Failure(munk score 2, 3 &amp; 4)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air bubble test</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>98</td>
<td>0</td>
<td>98</td>
</tr>
<tr>
<td>Sensitivity: 97.02%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+PV: 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Specificity: 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-PV: 40%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>101</td>
<td>2</td>
<td>103</td>
</tr>
</tbody>
</table>

DISCUSSION

During evolution of DCR procedure, Ext-DCR has remained the standard treatment of NLDO. Both anatomical and functional success rate are always assessed for the final success of DCR procedure. Functional success is evaluated according to patient symptoms and graded according to Munk scoring system. Although diagnostic lacrimal syringing is the gold standard test for assessing the anatomical success after DCR procedure, it has been associated with discomfort and sometimes pain (authors’ observation) and could cause puncto-canalicular damage.

ABT was firstly reported (a case report) in the name of valsalva bubble test in 1992 in which a positive test was considered as patent system after DCR surgery. It is a non invasive test without any potential to damage the lacrimal system to which the authors found no discomfort and pain in this series and others. It, however, may contaminate the ocular surface by potentially transferring the bacterial flora and mucosal debris from nose to the eye. Air bubble test was performed either by not putting any
drop\textsuperscript{8,11} or saline\textsuperscript{9} on the eye without any report of infection. Considering the potential infectious source resulted from bacterial change or overload in the cul-de-sac, they preferred to put an antibiotic drop and did not observe any case of conjunctivitis or any other infection after performing ABT. However, bacterial type and number of colonies in the cul-de-sac were not tested and compared before and after ABT, which could be a subject for the future studies in this regard. Frequency of positive ABT was similar in cases with and without common canalicular membranectomy (removal of Rosenmuller valve) during Ext-DCR procedure, implying that its presence was not related to 1-way valve action of Rosenmuller.\textsuperscript{11} Furthermore, not having positive ABT in normal subjects\textsuperscript{11,12} and a greater than normal pressure rise (after valsalva) in the lacrimal sac area after DCR procedure\textsuperscript{13} suggest that valve of Hasner may protect the upper lacrimal system from excessive intranasal pressure\textsuperscript{11} in normal subjects. ABT was assessed based on a questionnaire, completed by the patients, and reported to be positive in 47% after Ext-DCR\textsuperscript{11} and 45.5% after endonasal DCR\textsuperscript{12} procedure. Using different methods for reporting the ABT may account for the difference in its frequency. The best way to interpret a diagnostic test and evaluate its accuracy is by finding the sensitivity, specificity, and other reliability measures. However, an important caution is that neither sensitivity nor specificity takes into account the relative frequency of patent and obstructed nasolacrimal system. For this purpose, the positive and negative predictive values would be useful.\textsuperscript{14} Results of ABT were assessed against the anatomical success (positive irrigation test) and functional success (munk scoring) to calculate the reliability indices (Tables 1 and 2). This series showed that positive ABT means anatomically patent system (100% specificity). However, negative ABT does not mean anatomical failure.

Conclusion:
ABT is 100% specific for assessment of anatomical success after Ext-DCR procedure. While a positive ABT indicates a patent system, negative test does not mean an obstructed lacrimal system (Table 1). Therefore, in symptomatic patients after Ext-DCR procedure, a positive ABT obviates any need for further anatomical assessment of the lacrimal system. Air bubble test, like irrigation test,\textsuperscript{1} indicates a patent system, which still could be functionally disabled or anatomically stenosed.

REFERENCES