

# **Comparative Study between Surgical and Conservative Treatment of Children with Upper Obstetric Brachial Plexus Palsy**

Thesis Submitted in Partial Fulfillment of Master Degree in Physical  
Therapy

**By**

***Sherif Ahmed Wagdy El-Shennawy***  
B. Sc., in Physical Therapy

## **Supervisors**

***Prof. Dr. Kamal El-Sayed Shoukry***  
*Professor of Physical Therapy for  
Growth and Development Disorders in  
Children and its Surgery  
Faculty of Physical Therapy  
Cairo University*

***Prof. Dr. Yasser Ahmady El-Safoury***  
*Professor of Orthopedic surgery  
Faculty of Medicine  
Cairo University*

**Faculty of Physical Therapy  
Cairo University  
2009**

# دراسة مقارنة بين العلاج الجراحي و التحفظي عند الأطفال المصابين بشلل الضفيرة العضدية العلوي أثناء الولادة

رسالة مقدمة من

شريف أحمد وجدي الشناوي

توطئة للحصول على درجة الماجستير في العلاج الطبيعي

المشرفون

أ. د. ياسر أحمد الصافوري  
أستاذ جراحة العظام  
كلية الطب  
جامعة القاهرة

أ. د/ كمال السيد شكري  
أستاذ بقسم العلاج الطبيعي  
لاضطرابات مراحل النمو و التطور  
و جراحاتها عند الأطفال  
كلية العلاج الطبيعي  
جامعة القاهرة

كلية العلاج الطبيعي  
جامعة القاهرة  
٢٠٠٩

بسم الله الرحمن الرحيم

" قالوا سبحانك لا علم لنا إلا ما علمتنا إنك  
أنت العليم الحكيم "

صدق الله العظيم

البقرة ٣٢

## ***ACKNOWLEDGMENT***

*First and foremost "Thanks to GOD", the most merciful and kind.*

*I am very much indebted to **Prof. Dr. Kamal El-Sayed Shoukry**, Professor of physical therapy for growth and development disorders and its surgery, Faculty of Physical Therapy, Cairo University, I would like to express my deepest gratitude, great thanks, and appreciation to him for his close supervision, precious remarks and great experience and effort.*

*I am very grateful to **Prof. Dr. Yasser Ahmady El-Safoury**, Professor of Orthopedic Surgery, Faculty of medicine, Cairo University for his precious remarks, kind guidance and valuable advices that encouraged and helped me so much.*

*Last but not least, I would like to thank my precious and kind family, without their love, motivation, support and encouragement, this work would never have seen light.*

***Sherif El-Shennawy***

# Dedication

To the soul of my precious father;  
*Prof. Dr. Ahmed Wagdy El-Shennawy*  
Whom without him, I would not have  
been here today

**Comparative Study between Surgical and Conservative Treatment of Children with Upper Obstetric Brachial Plexus Palsy/ Sherif Ahmed Wagdy El-Shennawy. Supervisors: Prof. Dr. Kamal El-Sayed Shoukry, Faculty of Physical Therapy, Cairo University and Prof. Dr. Yasser Ahmady El-Safoury, Faculty of Medicine, Cairo University. Master Thesis, 2009.**

## **Abstract**

The purpose of this study was to differentiate between the effect of surgery (muscle transfer) and that of conservative treatment (a predetermined physical therapy program) on shoulder abduction and external rotation in obstetric brachial plexus palsy (OBPP) children. To achieve this goal, a modified digital electrogoniometer was used to examine thirty OBPP children (C5, 6, and 7 lesions) aging between 3 and 5 years. All children graded 3 or 4 according to the Mallet scale. Measurements of the degrees of shoulder abduction and external rotation were done before and after treatment; whether surgery (Group A: 15 child) or physical therapy (Group B: 15 child). The results of the study revealed a significant difference between the pre and post treatment mean values of shoulder abduction for group A. Also in group A, there was a high significant difference between the mean values of shoulder external rotation. While for group B, the difference between the mean values of both variables was highly significant. Comparing the post treatment results of both groups, the results revealed a high significant difference, with group B having higher mean values of both abduction and external rotation. It was thus concluded that, it may be more convenient for those patients to undergo a well organized physical therapy program and postpone surgery for a more appropriate time; as decided by the orthopedic surgeon.

**Keywords:** Obstetric brachial plexus palsy, digital electrogoniometer, and Mallet scale

دراسة مقارنة بين العلاج الجراحي و التحفظي عند الأطفال المصابين بشلل الضفيرة العضدية العلوي أثناء الولادة / شريف أحمد وجدي الشناوي ، إشراف أ.د / كمال السيد شكري أستاذ العلاج الطبيعي – قسم العلاج الطبيعي لاضطرابات مراحل النمو و التطور و جراحاتها عند الأطفال، كلية العلاج الطبيعي – جامعة القاهرة، أ.د / ياسر أحمد الصافوري أستاذ جراحة العظام – كلية الطب – جامعة القاهرة – رسالة ماجستير ٢٠٠٩

## المستخلص

تهدف هذه الدراسة إلي استبيان الفروق بين تأثير التدخل الجراحي (عملية نقل عضلات) و العلاج التحفظي (علاج طبيعي) علي عضلات تباعد الكتف و الدوران المحوري للخارج عند الأطفال المصابين بشلل الضفيرة العصبية العضدية العلوي أثناء الولادة. و قد تم اختيار ثلاثين طفلا مصابين بشلل الضفيرة العصبية العضدية العلوي (جذور أعصاب ٥، ٦، ٧) تتراوح أعمارهم من ٣-٥ سنوات. و قد تم تقييم و قياس المدى الحركي لحركة تباعد الكتف و الدوران الخارجي باستخدام جهاز المدى الحركي الرقمي المعدل و مقياس مالت قبل و بعد إجراء العلاج سواء كان هذا العلاج جراحي (مجموعة أ) أو علاج طبيعي (مجموعة ب). و قد أظهرت النتائج وجود فروق ذات دلالات إحصائية للمجموعة الأولى (مجموعة الجراحة) و فروق ذات دلالات إحصائية عاليه للمجموعة الثانية (مجموعة العلاج الطبيعي) وذلك عند مقارنة النتائج قبل العلاج و بعد العلاج. كما أظهرت النتائج وجود فروق ذات دلالات إحصائية عالية عند مقارنة النتائج بعد الجراحة و بعد العلاج الطبيعي لصالح المجموعة الثانية. وفقا للنتائج السابقة، نوصي بتنفيذ برنامج علاج طبيعي محدد للأطفال المصابين بشلل الضفيرة العصبية العضدية العلوي و تأجيل إجراء الجراحة إلي ما بعد الانتهاء من هذا البرنامج و ظهور نتائجه.

**الكلمات الدالة :** شلل الضفيرة العصبية العضدية أثناء الولادة، جهاز المدى الحركي الرقمي المعدل، مقياس مالت

# Contents

|   | Page |
|---|------|
| <b>List of Abbreviations</b>                        | i    |
| <b>List of Tables</b>                               | iii  |
| <b>List of Figures</b>                              | v    |
| <b>Chapter I: Introduction</b>                      | 1    |
| Statement of the problem                            | 2    |
| Purpose of the study                                | 2    |
| Significance of the study                           | 3    |
| Delimitations                                       | 3    |
| Limitations   | 3    |
| Basic assumptions                                   | 4    |
| Hypothesis  | 4    |
| <b>Chapter II: Literature Review</b>                | 5    |
| Introduction  | 5    |
| Anatomy   | 6    |
| Biomechanics of the Shoulder complex                | 7    |
| Risk factors  | 9    |
| Mechanism of injury                                 | 10   |
| Classification                                      | 10   |
| Prognosis   | 11   |
| Clinical picture                                    | 14   |
| Differential diagnosis                              | 15   |
| Classification of problems                          | 15   |
| Assessment  | 16   |
| Mallet system                                       | 19   |
| Electrogoniometer                                   | 20   |
| Treatment   | 21   |
| I. Surgical treatment                               | 21   |
| II. Conservative treatment                          | 25   |
| Decision making                                     | 27   |
| <b>Chapter III: Subjects, Materials and Methods</b> | 32   |
| Subjects  | 32   |
| Materials   | 33   |
| A. Materials for evaluation                         | 33   |
| 1- Modified digital Electrogoniometer               | 33   |
| 2- Mallet Scale                                     | 36   |
| B. Materials for treatment                          | 36   |
| Procedures  | 38   |



|   |             |
|---|-------------|
|   | <b>Page</b> |
| I- For evaluation   | 38          |
| A- Modified Digital Electrogoniometer                       | 38          |
| B- Mallet scale   | 41          |
| II- For treatment   | 42          |
| 1- Surgical procedure                                       | 42          |
| 2- Physical Therapy program                                 | 43          |
| Data Statistical Analysis                                   | 52          |
| <b>Chapter IV: Results</b>                                  | 53          |
| <b>Chapter V: Discussion</b>                                | 65          |
| <b>Chapter VI: Summary, Conclusion, and Recommendations</b> | 76          |
| <b>References</b>   | 79          |
| <b>Appendix</b>   | --          |
| <b>Arabic Summary</b>                                       | --          |

## List of Abbreviations

| Abbreviation | Name                             |
|--------------|----------------------------------|
| $\bar{X}$    | Arithmetic mean                  |
| ADLs         | Activities of Daily Living       |
| BoNT-A       | Botulinum Toxin Type-A           |
| C5           | Cervical nerve root 5            |
| C6           | Cervical nerve root 6            |
| C7           | Cervical nerve root 7            |
| C8           | Cervical nerve root 8            |
| CNS          | Central Nervous System           |
| DC           | Direct Current                   |
| EMG          | Electromyography                 |
| HS           | Highly Significant               |
| GH           | Glenohumeral joint               |
| in/mo        | Inch per month                   |
| mm/d         | Millimeter per day               |
| MRC          | Medical Research Council         |
| MUPs         | Motor Unit Potentials            |
| NS           | Non Significant                  |
| OBPI         | Obstetric Brachial Plexus Injury |
| OBPP         | Obstetric Brachial Plexus Palsy  |
| P            | Probability value                |
| PBPP         | Perinatal Brachial Plexus Palsy  |
| S            | Significant                      |
| SD           | Standard Deviation               |

| Abbreviation | Name                                  |
|--------------|---------------------------------------|
| Sig.         | Level of significance                 |
| SPSS         | Statistical Package of Social Science |
| t            | Un-paired t-test                      |
| T            | Paired t-test                         |
| T1           | Thoracic nerve root 1                 |
| T2           | Thoracic nerve root 2                 |
| UBPP         | Upper Brachial Plexus Palsy           |
| UEMA         | Upper Extremity Motion Analysis       |
| UOBPP        | Upper Obstetric Brachial Plexus Palsy |

## List of Tables

| <b>Table No.</b> | <b>Title</b>  | <b>Page</b> |
|------------------|---|-------------|
| <b>1</b>         | Descriptive data of group A and group B   | <b>73</b>   |
| <b>2</b>         | Frequency distribution of sex and affected side in both groups  | <b>74</b>   |
| <b>3</b>         | Mallet scores for group A and group B   | <b>75</b>   |
| <b>4</b>         | Comparisons between groups (A) and (B) in their pre-treatment mean values of the degree of shoulder abduction           | <b>76</b>   |
| <b>5</b>         | Comparisons between the pre and post treatment mean values of the degree of shoulder abduction within group (A)         | <b>77</b>   |
| <b>6</b>         | Comparisons between the pre and post treatment mean values of the degree of shoulder abduction within group (B)         | <b>78</b>   |
| <b>7</b>         | Comparisons between groups (A) and (B) in their post treatment mean values of the degree of shoulder abduction          | <b>80</b>   |
| <b>8</b>         | Comparisons between groups (A) and (B) in their pre-treatment mean values of the degree of shoulder external rotation   | <b>81</b>   |
| <b>9</b>         | Comparisons between the pre and post treatment mean values of the degree of shoulder external rotation within group (A) | <b>82</b>   |
| <b>10</b>        | Comparisons between the pre and post treatment mean values of the degree of shoulder external rotation within group (B) | <b>83</b>   |
| <b>11</b>        | Comparisons between groups (A) and (B) in their post-treatment mean values of the degree of shoulder external rotation  | <b>85</b>   |

## List of Figures

| <b>Figure No.</b> | <b>Title</b>  | <b>Page</b> |
|-------------------|---|-------------|
| <b>1</b>          | Shoulder dystocia with Brachial Plexus injury   | <b>6</b>    |
| <b>2</b>          | Anatomy of the Brachial plexus ( <b>Gray, 1918</b> ).   | <b>8</b>    |
| <b>3</b>          | The joints of the Shoulder complex  | <b>9</b>    |
| <b>4</b>          | Muscles of the shoulder complex   | <b>10</b>   |
| <b>5</b>          | (A), (B), and (C) The modified digital Electrogoniometer. (a): the electrogoniometer with the digital display, (b) are the two copper arms, and (c) are the Velcro straps   | <b>49</b>   |
| <b>6</b>          | Materials used for treatment. (A) Mat or plinth, (B) wedge, and (C) roll  | <b>50</b>   |
| <b>7</b>          | The sandbags used to apply resistance during the strengthening exercises  | <b>50</b>   |
| <b>8</b>          | Finger ladder   | <b>51</b>   |
| <b>9</b>          | Toys and rubber balls used for treatment of children in group B   | <b>51</b>   |
| <b>10</b>         | Placement of a sticky marker for identification of the anterior aspect of the acromion process for measuring shoulder abduction   | <b>53</b>   |
| <b>11</b>         | Placement of a sticky marker for identification of the olecranon process for measuring shoulder external rotation   | <b>54</b>   |
| <b>12</b>         | Measurement of shoulder abduction. Child is supine lying. The two arms of the electrogoniometer fixed parallel to the trunk and the arm. The fulcrum of the electrogoniometer fixed on the anterior aspect of the acromion process  | <b>56</b>   |
| <b>13</b>         | Mallet classification (Gilbert and Tassin 1987)   | <b>57</b>   |
| <b>14</b>         | Stretching the Scapulohumeral adhesions. Child placed in the side lying position on the non-affected side and the therapist was sitting or standing behind him at the level of the thoracic region. The child's shoulder passively and gently abducted with the elbow kept extended | <b>60</b>   |

## List of Figures (Contd.)

| <b>Figure No.</b> | <b>Title</b>   | <b>Page</b> |
|-------------------|--|-------------|
| <b>15</b>         | Stretching the Subscapularis muscle. Child placed in the supine lying position. The upper arm fixed in adduction so as the arm is totally contacting the trunk. The elbow flexed 90°. The child's forearm gently and slowly rotated laterally        | <b>61</b>   |
| <b>16</b>         | Stretching the forearm pronators. Child placed in the supine lying position with the arm adducted close to the trunk and the elbow flexed 90°. Child's forearm rotated outwards so that the volar aspect of the forearm was towards the child's head | <b>62</b>   |
| <b>17</b>         | Strengthening the scapular protractors from supine lying and the elbow fixed in extension using elbow immobilizer  | <b>64</b>   |
| <b>18</b>         | Strengthening of the scapular elevators from sitting. The trunk is supported using a belt across the chest   | <b>65</b>   |
| <b>19</b>         | Strengthening the shoulder abductors from the supine lying position  | <b>66</b>   |
| <b>20</b>         | Strengthening the elbow extensors from the supine lying position   | <b>67</b>   |
| <b>21</b>         | Mean values of age in both study groups  | <b>73</b>   |
| <b>22</b>         | Sex and affected side distribution in both groups  | <b>74</b>   |
| <b>23</b>         | Percentage of Mallet scores in both groups   | <b>75</b>   |
| <b>24</b>         | Mean values of the degree of shoulder abduction preoperatively and before the physical therapy program   | <b>76</b>   |
| <b>25</b>         | Mean values of the Electrogoniometric measurements of shoulder abduction pre and post operatively  | <b>77</b>   |
| <b>26</b>         | Mean values of the Electrogoniometric measurements of shoulder abduction before and after physical therapy program   | <b>79</b>   |
| <b>27</b>         | Mean values of the Electrogoniometric measurements of shoulder abduction post operatively and after the physical therapy program   | <b>80</b>   |

## **List of Figures (Contd.)**

| <b>Figure No.</b> | <b>Title</b>   | <b>Page</b> |
|-------------------|--|-------------|
| <b>28</b>         | Mean values of the degree of shoulder external rotation pre operatively and before the physical therapy program                          | <b>81</b>   |
| <b>29</b>         | Mean values of the Electrogoniometric measurements of shoulder external rotation pre and post operatively                                | <b>82</b>   |
| <b>30</b>         | Mean values of the Electrogoniometric measurements of shoulder abduction before and after physical therapy program                       | <b>84</b>   |
| <b>31</b>         | Mean values of the Electrogoniometric measurements of shoulder external rotation post operatively and after the physical therapy program | <b>85</b>   |