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Benefit of physiotherapeutic treatment in children with torticollis

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ABSTRACT

INTRODUCTION: The incidence of torticollis, which is often accompanied by some degree of plagiocephaly in infants, has remained increased since the introduction of the supine sleeping position to prevent sudden infant death. Recently, instruments allowing quantitative measurement of torticollis and related pathology have been developed and validated. The aim of the present study was to monitor a cohort of children with torticollis using a standardised protocol including valid and reliable measurements.

METHODS: A total of 136 infants diagnosed with torticollis and referred to physiotherapeutic treatment in four paediatric departments were included (October 2009-April 2011). Trained and calibrated physiotherapists assessed their cervical range of motion (ROM), cervical muscle function and severity of plagiocephaly prior to and after the treatment period.

RESULTS: The infants' median age was three months at inclusion and seven months at the end of the treatment period that comprised a median of five treatment sessions. Initially, 52% and 54% presented with ROM deficits in rotation and lateral flexion, respectively. After treatment, these percentages were reduced to 6% and 14%, and the magnitudes of the remaining ROM deficits were substantially reduced. Plagiocephaly improved in 82, remained unchanged in 18 and deteriorated in five of 105 infants with complete follow-up. Symmetrical or almost symmetrical muscle function was achieved in 93% (n = 101).

CONCLUSION: A successful outcome was achieved in the majority (90%) of children with torticollis with less than ten physiotherapeutic treatment sessions.

FUNDING: not relevant.

TRIAL REGISTRATION: not relevant.

Large increases in the prevalence of torticollis and plagiocephaly have been documented both internationally (more than a six-fold increase) [1] and locally in the Capital Region of Denmark (almost a five-fold increase) [2] following the introduction of the supine sleeping campaign introduced to prevent sudden infant death syndrome.

In general, torticollis is defined as a head tilt and/or rotation in combination with an asymmetrical range of motion (ROM) of the cervical spine with limited rotation, and/or lateral flexion often associated with a tight sternocleidomastoid (SCM) muscle with or without a palpable mass [3]. More specific definitions including attempts to quantify asymmetries of neck ROM (lateral flexion and/or rotation) have been presented [4-6], all using a cut-off value of 15° of side-to-side asymmetry of ROM to define torticollis. Two studies [4, 5] assessed passive ROM using an objective measure of angular ROM, whereas one study [6] used subjectively assessed active ROM. The reliability of the objective assessments of neck ROM was reported to be acceptable [7], whereas the reliability of the subjective assessment was not reported.

In clinical practice, children characterised by one or more of the following conditions are referred to physical therapy in the Capital Region of Denmark. All children presented with torticollis (with or without a tight SCM and with or without a palpable mass), preferred head rotation and some degree of plagiocephaly. For practical reasons, the term torticollis will be used to cover this spectrum of conditions in the following.

Through implementation of standardised measurements, a more detailed description of the specific deficits in children with torticollis would be possible and enable even more targeted treatment. Furthermore, the use of valid and reliable (outcome) measurements is necessary to systematically document the treatment effect.

Consequently, the aim of the present study was to monitor a cohort of children with torticollis treated at the four departments of paediatrics in the Capital Region of Denmark using a standardised protocol including valid and reliable measurements.

METHODS

In 2009, ten physiotherapists from the four departments of paediatrics in the Capital Region of Denmark embarked on a common effort to optimise and standardise the examination and treatment of children with torticollis. A systematic literature search revealed that standardised tests and (outcome) measurements had recently been developed and validated.

A manual for the physiotherapeutic examination including standardised measurements of ROM [4, 7, 8], muscle function [9] and plagiocehpaly [10] was devel-

ORIGINAL ARTICLE

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Dan Med J 2014;61(12):A4970

FIGURE

Standardised measurement techniques used to collect the following data in a cohort of infants with torticollis: cervical range of motion – rotation (A), cervical range of motion – lateral flexion (B), the Arthrodial Protractor Goniometer, (Kom Kare Company, Carlisle, Ohio, USA) (C) and Muscle Function Scale (D): The child is held horizontally and side-lying in front of a mirror, and the head position is scored on a 0-5 scale with 0 indicating head below the horizontal line and 5 indicating a close to vertical head position. Photos: Lena Hautopp and Susanne Wester.



oped. A detailed instruction on how to perform the tests and measurements was included, and all physiotherapists participated in instruction and calibration sessions. Thus, the measurements were standardised and the physiotherapists were calibrated before the data collection for the prospective cohort study was initiated. Moreover, the physiotherapists frequently met to ensure maintenance of standardisation regarding examination procedures and skills as well as data recording.

Data were collected and entered into a common database.

The cohort consisted of 136 children referred with a diagnosis of torticollis to one of the paediatric departments from October 2009 to April 2011. Depending on the number of physiotherapists who were included in the project in each department, the children were included either consecutively (if all physiotherapists in the department were included) or randomly depending on whether or not the physiotherapist who treated the child was included in the project. Thus, no selection of subjects was performed since a mix of random and consecutive inclusion was used.

The following characteristics were registered at inclusion in the study: gender, age, premature (yes/no), first born (yes/no), twins (yes/no – twin A or B) and palpable mass in the affected sternocleidomastoid muscle (yes/no).

The investigation included the following measurements:

The ROM of the cervical columna was measured

TABLE 1

Baseline characteristics of the 136 children with torticollis.

Age, months, median (interquartile range) (N = 136) ^a	3 (2-5)
Gender, n (%) (N = 136)°	
Boys	84 (62%)
Girls	52 (38%) ^b
Premature, n (%; 95% Cl)	18 (13.8; 8.4-21.0) ^c
[average in DK 2010, %]	[6.3]
(N = 130) ^a	
Firstborn, n (%; 95% Cl)	87 (68.0; 59.1-75.9) ^d
[average in DK 2010, %]	[44.1]
(N = 128) ^a	
Twins, n (%; 95% CI)	15 (11.4; 6.5-18.0) ^e
[average in the Capital Region of DK]	[2.0]
(N = 132) ^a	
CI = confidence interval; DK = Denmark.	

a) N is presented as all information was not available for all children.

b) Significantly more boys than girls (p = 0.006).

c) Significantly different from the average in Denmark (p = 0.002).

d) Significantly different from the average in Denmark (p < 0.0001). e) Significantly different from the average in the Capital Region of DK (p < 0.0001).

with Arthrodial Protractor (Kom Kare Company, Carlisle, Ohio, USA) as illustrated in **Figure 1**A-C. Klackenberg et al [8] found excellent intra-tester reliability when measuring ROM in children with torticollis using this instrument to measure lateral flexion – i.e. Intraclass Correlation Coefficient (ICC)_{1.1}-values were generally well above 0.90 and a minimal detectable change for individual children with 95% confidence interval (Cl) as low as 5°. Acceptable inter-tester reliability (ICC 0.71) has been reported for measurements of rotational ROM [7].

Muscle function of the lateral flexors of the neck was assessed with the test Muscle Function Scale (MFS) [9]. The scale is a 0-5 scale in which 0 indicates head below the horizontal line when the child is held horizontally and side lying in front of a mirror (Figure 1D), and 5 indicating a close to vertical head position. High intraand inter-tester reliability – i.e. weighted kappa-values of 0.96-0.99 and ICC_{2.1}-values above 0.90 – have been reported [9]. MFS and measurement of passive ROM using the Arthrodial Protractor have recently been recommended in the Clinical Practice Guidelines for Physical Therapy Management of torticollis developed by the American Physiotherapy Association [11].

Asymmetry of the cranium and face was assessed with the Severity Assessment for Plagiocephaly [10]. The test is divided into five items: posterior flattening, ear misalignment, forehead asymmetry, neck involvement (head tilt) and facial asymmetry. Each item is scored on a 0-3 scale, 0 indicating normal symmetrical head shape and three indicating severe plagiocephaly [10]. Acceptable intra- and inter-tester reliability (weighted kappa-values of 0.71 and 0.68, respectively) was observed in a large group of physiotherapists with no training in the use of the scale when they evaluated pictures of children with varying degrees of plagiocephaly [10]. The more experienced physiotherapists generally exhibited better agreement.

All of the measurements were performed at the beginning and at the end of the treatment period. The number of treatments and the period of treatment were also recorded.

In accordance with Clinical Practice Guidelines for Physical Therapy Management of Torticollis [11], the treatment primarily focused on normalisation of active and passive cervical ROM and muscle function. Parental education, handling, and strength and stretching exercises were key components of the treatment algorithm.

Data analysis

Descriptive statistics were calculated for the demographic characteristics of the cohort – i.e. gender, age and prevalence of premature births, multiple pregnancies and first-borns. The prevalence of these characteristics was compared with the respective national or regional prevalences during the study period (2010) using Fisher's exact test. The χ^2 -test was used to investigate the gender ratio and the Mann Whitney U-test was used to investigate differences in age and number of treatments between children with and without a palpable mass in the affected sternocleidomastoid muscle.

Calculation of deficits in cervical ROM was performed. 90° was defined as a normal rotational ROM. Consequently, a deficit of 20° was recorded for a rotational ROM of 70°, and all children recording more than 90° were thus classified as normal with a 0° deficit. Similarly, 50° was defined as normal lateral flexion ROM.

The number of children with ROM deficits at inclusion and at the end of treatment was recorded. Muscle function of the lateral flexors of the cervical spine was recorded using a 0-5 point MFS. MFS cannot be used in children younger than two months. Moreover, in the present age range, the MFS score will increase as the child matures. Thus, only the degree of symmetry after treatment was investigated. The Plagiocephaly Score was recorded at the beginning and at the end of treatment.

Trial registration: not relevant.

RESULTS

A total of 136 children with torticollis were included in the present cohort. The characteristics of the children at inclusion are presented in **Table 1**. As illustrated, significant differences from the percentage of first born chil-

The proportion of children with a reduced cervical range of motion (the darker area of pie charts) at the beginning of the treatment period **A** (rotation) and **B** (lateral flexion) and at the end of the treatment period **C** (rotation) and **D** (lateral flexion). It should be noted that the charts represent all children with available measurements at the given time point; due to incomplete follow-up, the number of children with end of treatment measurements was lower than the initial number of children: A and B (n = 135), C (n = 116) and D (n = 115).



dren and premature children in Denmark [12] were observed. Moreover, the percentage of twins differed significantly from the percentage in the Capital Region of Denmark and more boys than girls were referred to treatment.

A median of five (range: 1-35) physical therapy consultations were administered per child. Less than ten consultations were administered in 90% of the children.

The median age of the children was three (interquartile range: 2-5) months at inclusion and seven (interquartile range: 5-9) months at the end of the treatment period. A complete follow-up was not achieved as not all children had completed the intervention at the end of the data collection period, and some children missed the appointment for the final measurements. Consequently, (n) is reported for each parameter in the following.

Figure 2 illustrates a substantial decrease in the proportion of the children with reduced cervical ROM during the treatment period. In addition, the magnitude of the observed ROM deficits decreased from 5°-70° to 5°-15° (rotation) and from 5°-40° to 5°-10° (lateral flexion) during the treatment period. The plagiocephaly score decreased from a median of five (range: 0-11) (n = 129) at inclusion to three (range: 0-8) (n = 106) after treatment. In 105 children, both pre- and post plagiocephaly scores were available. In these children, 82 im-

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Side-to-side difference (asymmetry) of the cervical lateral flexor muscle function measured using the Muscle Function Scale (MFS) at the end of the treatment period. The x-axis illustrates the side-to-side difference (right side-left side); thus, 0 indicates symmetry and positive values indicate an increased right lateral flexor function, whereas negative values indicate an increased left lateral flexor function. The number of infants is indicated for each score illustrating symmetrical or almost symmetrical results (a difference of only one point) in 94 of the 101 infants with a complete end of treatment MFS assessment.



proved, 18 remained unchanged (2 scored 0 initially) and five deteriorated.

The MFS was used to assess the degree of symmetry between muscle function of the lateral flexors of the affected compared with the unaffected side. **Figure 3** illustrates that a rather large proportion achieved complete or almost complete (a one-point difference) symmetry. A total of 14 children had a palpable mass in the affected SCM. These children needed more consultations (a median of eight, range: 4-35) than the remaining children with torticollis (a median of five, range: 1-18) (p < 0.001). They were referred to treatment at a younger age of one (range: 0-3) versus three (range: 1-66) months (p < 0.001). Moreover, a deterioration of the plagiocephaly score was observed more often in these children. In fact, three of the five children with a deteriorated plagioceph-aly score had a palpable mass in the affected SCM.

DISCUSSION

Implementation of valid and reliable measurements resulted in increased quality and standardisation of the physiotherapeutic examination and treatment of infants with torticollis. Moreover, the measurements were used in a prospective cohort investigation illustrating that relatively few (a median of five) treatment sessions lead to a successful outcome – i.e. normalised ROM and muscle function.

The baseline characteristics of the present cohort were in accordance with previous investigations summarised by Knudsen et al [13] – i.e. more boys than girls were referred and the percentages of premature children, firstborn children and twins were significantly higher than the corresponding percentages recorded nationally [12] and regionally.

The lack of a control group and the incomplete follow-up are obvious limitations of the present study preventing firm cause and effect conclusions regarding the treatment effect.

The standardised measurements have enabled a more detailed monitoring of relevant outcome measures such as ROM and muscle function throughout the treatment period. In fact, the treatment was continued until normalised ROM and side-to-side symmetry of muscle function was achieved. As previously observed [14], for the vast majority of the children in whom absolute symmetry of muscle function could not be achieved, a difference of only one point remained (Figure 3).

As the craniofacial deformity is often observed to be a major focus for parents, the plagiocephaly score was of great value as a pedagogical instrument to show progress and to motivate the parents to continue positioning, handling and strength exercises.

It has been suggested that early referral and treatment initiation may result in a better outcome regarding successful modelling of craniofacial deformities in children with torticollis [15]. Moreover, a large cohort study has demonstrated better outcome regarding ROM and reduction of head inclination with earlier initiation of physiotherapeutic treatment [16]. Moreover, recently the Clinical Practice Guidelines for Physical Therapy Management of torticollis [11] reported the highest level of evidence for early initiation of treatment. Early intervention may also shorten the time to achieve symmetrical muscle function [14].

This is in accordance with our clinical experience. It can, however, not be documented by the present data as the children referred and treated early were very often characterised by a more serious condition – i.e. a palpable mass in the affected SCM. They were consequently less likely to achieve a good outcome with fewer consultations. The children with a palpable mass in the SCM constituted a well-defined subgroup in need of more consultations to achieve an acceptable result. To reflect the general clinical practice where these children are also diagnosed with and treated for torticollis, they were included in the present cohort.

CONCLUSION

A successful outcome was achieved in the vast majority of children with torticollis through less than ten (a median of five) physiotherapeutic treatment sessions.

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CONFLICTS OF INTEREST: none. Disclosure forms provided by the authors are available with the full text of this article at www.danmedj.dk.

ACKNOWLEDGEMENTS: We would like to extend our gratitude to Anne-Mette Nørgaard, Department of Physiotherapy, Glostrup Hospital, for project initiation and data collection, and to Tobias Wierenfeldt Klausen, Department of Haematology L, Herlev Hospital, for statistical advice.

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