Original Article

Scapular waist retraction in newborns admitted to an Intermediate Care Unit

Retração de cintura escapular em recém-nascidos internados em uma Unidade de Cuidados Intermediários

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ABSTRACT | INTRODUCTION: Neonatal care units have high technological resources that, together with the advancement of science, aim to ensure the survival of newborns (NBs). However, hospitalization exposes newborns to various stimuli that, associated with inadequate care, can favor the appearance of postural changes. **OBJECTIVE:** To investigate the frequency of signs suggestive of scapular waist retraction in newborns who required hospitalization. Materials and **METHODS:** Observational, quantitative, and longitudinal study, carried out with 16 newborns, admitted to the Intermediate Care Unit (ICU) of a state hospital, located in the city of Salvador, Bahia, in the year 2019. Data were collected through scapula measurements, scarf signs, biomechanical inspection protocol, and medical records. **RESULTS:** Seven (43.7%) of the newborns showed signs suggestive of scapular waist retraction. Six (37.5%) showed a positive scarf sign and only one (6.3%) simultaneously showed signs of the abduction of the upper limbs, scapular adduction, positive scarf sign, and reduced scapular measurements in relation to the spine along with hospitalization. The comparison between the difference between the highest and lowest scapular measurements, with the scarf sign, was not statistically significant. However, those who showed a positive scarf sign and/or reduced measurements reached maximum values for days of hospitalization. **CONCLUSION:** Signs suggestive of scapular waist retraction were present in almost half of the sample. It is important to note that these findings reflect the characteristics of the study population, considering their limitations.

KEYWORDS: Newborn. Musculoskeletal abnormality. Hospitalization. Scapulas.

RESUMO | INTRODUÇÃO: As unidades de cuidados neonatais dispõem de altos recursos tecnológicos que, aliados ao avanço da ciência, visam garantir a sobrevida de recém-nascidos (RNs). Entretanto, o internamento expõe os RNs a variados estímulos que, associados a assistência inadequada, podem favorecer o surgimento de alterações posturais. **OBJETIVO:** Investigar a frequência dos sinais sugestivos de retração de cintura escapular em RNs que necessitaram de internamento. **MATERIAIS E MÉTODOS:** Estudo observacional, quantitativo e longitudinal, realizado com 16 RNs, internados na Unidade de Cuidados Intermediários (UCI) de um hospital estadual, localizado na cidade de cidade de Salvador, Bahia, no ano de 2019. Os dados foram coletados por meio de medidas das escápulas, sinal do cachecol, protocolo de inspeção biomecânica e prontuários. **RESULTADOS:** Sete (43,7%) RNs apresentaram sinais sugestivos de retração de cintura escapular. Seis (37,5%) apresentaram sinal do cachecol positivo e apenas um (6,3%) apresentou simultaneamente os sinais de abdução de membros superiores, adução escapular, sinal do cachecol positivo e redução das medidas das escápulas em relação à coluna ao longo do internamento. A comparação entre a diferença do maior e do menor valor das medidas das escápulas, com o sinal do cachecol, não foi estatisticamente significante. Porém, aqueles que apresentaram sinal do cachecol positivo e/ou diminuição das medidas atingiram valores máximos de dias de internamento. **CONCLUSÃO:** Os sinais sugestivos de retração de cintura escapular estiveram presentes em quase metade da amostra. Importante salientar que esses achados traduzem as características específicas da população do estudo, considerando suas limitações.

PALAVRAS-CHAVE: Recém-nascido. Anormalidades Musculoesqueléticas. Hospitalização. Escápula.

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Introduction

Neonatal care units are structurally prepared environments to meet the varied demands, having a series of high technology equipment, which allied to the advance of science, aim to ensure the survival of newborns (NBs). However, despite the benefits, the routine in hospital units exposes the NBs to excessive sensory stimuli that can be harmful to their development. In this sense, they tend to face major challenges in maintaining self-organization and adjustment to the extrauterine environment[1,2].

Positioning is one of the procedures performed in neonatal units, which can exert great influence on the neuromotor development of NBs since the systems neurological and musculoskeletal are in a constant process of formation in this phase of life[1]. Thus, when the NBs, especially the premature ones, are incorrectly positioned or kept in a restricted position for long periods, they tend to develop postural changes, such as trunk hyperextension, which predisposes the appearance of a predominantly fixed posture of scapular waist retraction[1-4]. This may be associated with shoulder lifting, external rotation and abduction, elbow flexion, and hyperextension of the cervical spine[5,6]. Also, all these changes may compromise the range of motion of the shoulder/upper limbs complex[1].

Among the physiological mechanisms that may be involved in the development of the scapular waist retraction in NBs, we highlight the imbalance between the action of muscles flexors and extensors of the trunk; the transitory alteration of the muscle tone; and the action of the gravity against a neurologically immature musculature, especially in premature newborns. The development of hypertonia in the trapezius muscles (middle portion) and rhomboids, the main adductors of the scapulas, can also contribute to the development of this change[7].

Scapular waist retraction can lead to functional limitations along with the development because it takes the NB away from the middle line orientation, with the consequent deficit in the eye-hand coordination[8], delay in exploratory activities of taking the hand to the mouth[9] hand to hand, manipulate and transfer objects, important tasks in the first year of life[10]. Moreover, the limitation to carry out the movement to reach four and six months of life can be associated with a change in fine motor coordination around the age of six or in the school phase[11]. In this context, although the association between postural alterations and developmental interferences has already been established in the literature, few studies have investigated suggestive signs of scapular waist retraction as the main result. Therefore, it is relevant knowledge on this topic since it can be associated with functional limitations and delays in motor acquisition throughout the child's development[7,9,11,12].

This study aimed to investigate the frequency of signs suggestive of retraction of the scapular waist in newborns who needed hospitalization in a specialized neonatal care unit.

Methods

It is a quantitative, observational, and longitudinal study. The population was composed of NBs admitted to the Intermediate Care Unit (ICU) of an institution state hospital of the Unified Health System (SUS), reference in Neonatology, located in the city of Salvador, Bahia. To this, the study included those NBs who needed hospitalization in the first 48 hours of life and who did not show suspicion or diagnosis of syndrome genetics, brachial paralysis, or congenital malformation. In addition, faced with the risk of peri-intraventricular hemorrhage, preterm neonates with gestational age (GA) of less than 33 weeks were not included in the sample, considering the need for ventral decubitus positioning.

The exclusion criterion for the study was irritability without response to a non-nutritive suction stimulus to adjust the behavioral state during the performance of the scapulas placement or scarf sign. The sampling of the study was by convenience.

The data collection period was from July to November 2019. To avoid possible inconsistencies in the results, the evaluations were carried out by only one of the researchers. A pilot study with five NBs was conducted in order to calibrate the application of the evaluation tools used and the processes related to the collection of data.

On data collection days, researchers visited the ICU identifying those NBs that met the inclusion criteria of the study, as well as carrying out the evaluations/ follow-up of those already included in the survey. The evaluations were held three times a week, starting the day the NB is admitted to the unit until the day of the medical discharge in the sector. Behavioral states of alert or alert with activity (states four and five of the Brazelton scale, respectively)[13] were considered necessary during the collections because these are essential states to obtain the appropriate responses, since in behavioral states of drowsiness or crying there may be a change in the muscle tonus, which could interfere with the results obtained[13]. Therefore, when necessary, the stimulus to the non-nutritive suction was performed for a better adaptation of the behavior state.

Faced with the scarcity of validated measures in the literature that would allow the identification/diagnosis of suggestive signs of scapular waist retraction, the data collection protocol used more than one evaluation measure. To perform the research, a structured form containing variables about the demographic and clinical characteristics of the NBs and variables related to hospitalization stay was developed by the authors of the study. The analysis of postural biomechanics was performed using a biomechanical inspection protocol, elaborated by the researchers of the study, and based on the variables from the study of Georgieff and Bembaum[10] and Oliveira et al.[14].

The evaluation of the mobility of the scapular waist/ upper limb complex was performed by the scarf signal, analyzing the location of the olecranon compared to the midline trunk. When this signal was altered, it suggested compromising the mobility of the scapular waist, through the resistance offered to movement in the presence of hypertonia or complete absence of resistance in the presence of muscular hypotonia. To perform the signal of the scarf, passively the NB upper limbs were moved in anterior flexion and adduction over the thorax, so that the distal end would reach the contralateral shoulder, analyzing the position assumed by the olecranon in relation to the midline of the trunk[13,15].

In this study, the change in scarf signal was considered positive for hypertonia when, in the term NBs, the olecranon could not reach the midline of the trunk, and in the premature when the olecranon has not crossed the midline, in other words, when the olecranon only reached the middle line or could not reach it.

The evaluation of the positioning of the scapulas was made by means of measures in centimeters, from the distances from the upper and lower medial scapular edges to the spine[3]. These measures were performed with the NBs in the high prone position, on a positioner (cueiro), in the vertical position, the length of this was the distance from the face (zygomatic arch) to the lower region of the trunk and the width the distance between the right and left axillaries lines, based on the studies by Monfort and Smith[3]. After the NB has been positioned, the measures were carried out twice during the evaluation, the first measurements were performed with the cervical in rotation to the right and the second measurements with the cervical spine rotating to the left, in order to identify if the rotation of the cervical spine exercised influence on scapular positioning.

After data collection, they were tabulated and statistical analyses were performed in two steps. In the first of them, descriptive statistics concepts were used to calculate the absolute and relative (percentage) frequencies of the categorical variables, in addition to the measures of central tendency (mean or median) and measures of dispersion (standard deviation or interquartile intervals) of continuous variables. After the univariate descriptive analysis, the bivariate analysis was used to test the association between the outcome (suggestive signs of scapular waist retraction) and the other clinical variables of the NBs.

To observe the differences in the means of the quantitative variables according to the presence/absence of signs suggestive of scapular waist retraction, measured by the scarf sign, Student's T Test was calculated. In all bivariate analyses the associations whose p value was less than 0.05 (p value <0.05) were considered statistically significant. The data were tabulated in Microsoft Excel 2013 text spreadsheets and then a data checking and cleaning procedure were carried out to avoid possible inconsistencies in the results, right after, the data was analyzed in the statistical analysis software Stata, v.12. The research project was approved by the Ethics Committee in the hospital survey by CAAE:11638119.0.0000.5028.

Results

In the period from July to November 2019, 16 NBs met the eligibility criteria. Among these NBs, 10 (62.5%) were from the male gender. The most frequent clinical diagnoses were prematurity and respiratory distress syndrome, observed in 11 children (68.7%) (Table 1).

Seven (43.7%) NBs showed suggestive signs of scapular waist retraction. The positive scarf sign was observed in six (37.5%) NBs, shoulder abduction and scapular adduction were observed in only one (6.3%) participant (Table 2).

Among those who presented the suggestive signs, two (28.5%) were preterm borderline, at 34 weeks of GA, five (71.4%) were full-term, with GA greater than or equal to 37 weeks; two (28.5%) used central access (right jugular and right upper limb respectively), and one (14.2%) was submitted to a surgical procedure (open cystostomy). Of those who showed positive scarf sign, only one (16.6%) was premature. The mean hospital stay was 15 days (SD ± 10.9).

It was observed that the rotation of the cervical spine had no influence on the measures of the medial edges of the scapulas in relation to the column, for this reason, the analysis of the presented measurements in this study was related to cervical rotation to the right. Table 3 presents the measurements of the distances from the medial edges of the scapulas in relation to the NBs column. The greatest mean distances were observed at the Right Lower Edge (RLE) (Mean=3.26; SD 0.40) and on the Left Lower Edge (LLE) (Mean=3.26; SD 0.41). The difference between LLE measurements, comparing the first and last day of ICU stay, was 0.41 centimeters (SD ± 0.34)

When comparing the scarf sign with the differences in the Right Upper Edge (URE) and the LLE of the scapulas in relation to the column, were not verified statistically significant values (Table 4).

The comparison of the average number of days of hospitalization among NBs with the presence or absence of scarf sign evidenced that those who showed positive scarf sign had a longer hospitalization, compared to those who did not show the scarf sign (Graph 1).

Three participants in this study who were submitted to a longer period of hospitalization evolved with progressive reductions of the measurements of the medial edges of the scapulas in relation to the column. Also, one of the three participants, who had a longer period of hospitalization in relation to the others, presented together with the reduction of the LLE of the scapula, the positive scarf sign and upper limbs abduction with scapula adduction.

The other variables related to the hospital stay, such as the use of Invasive Mechanical Ventilation (IMV), Non-Invasive Mechanical Ventilation (NIV), use of Sedation or Peritoneal Ventricle Derivation (PVD), showed no influence among patients who showed suggestive signs of scapular waist retraction. This may have occurred due to the participants' characteristics in this study, which did not make much use of these devices.

Table 1. Demographic characteristics and clinics of newborns admitted to a Intermediate Care Unit, from a public hospital, Salvador, Bahia, 2019

Variables		n (%)
Gender		
	Male	10 (62,5)
	Female	6 (37,5)
APGAR 1'		
	≤ 7	3 (18,7)
	>7	13 (81,2)
APGAR 5'		
	≤ 7	0 (0,0)
	>7	16 (100,0)
Clinical Diagnosis		
	Prematurity	11 (68,7)
	AGA	7 (43,8)
	SGA	5 (31,3)
	RDS	11 (68,7)
	IR	7 (43,7)
	MR	10 (62,5)
	RTORCHS	5 (31,2)

AGA= Appropriate for Gestational Age; SGA= Small for Gestational Age; RDS= Respiratory Distress Syndrome; IR = Infection Risk; MR = Metabolic Risk; RTORCHS = Risk of Toxoplasmosis, Rubella, Cytomegalovirusand Herpessimple.

Source: Authors' data.

Table 2. Signs suggesting scapular waist retraction in hospitalized newborns in an Intermediate Care Unit of a public hospital, Salvador, Bahia, 2019

Variables		n (%)
Scarf sign		
	Yes	6 (37,5)
	No	10 (62,5)
Shoulder abduction		
	Yes	1 (6,3)
	No	15 (93,8)
Scapular adduction		
	Yes	1 (6,3)
	No	15 (93,8)

Source: Authors' data.

Table 3. Averages of the measures of the distances from the medial edges of the scapulae in relation to the spine, of newborns admitted to an Intermediate Care Unit, of a public hospital, Salvador, Bahia, 2019

Variables	Averages	Standard Deviation	Minimum	Maximum
URE	2,47	0,44	1,73	3,40
LRE	3,26	0,40	2,61	4, 05
URE difference	0,29	0,20	0,10	0,80
ULE	2,47	0,48	1,76	3,60
LLE	3,26	0,41	2,63	4,10
LLE difference	0,42	0,34	0,00	1,10

URE = Upper Right Edge; LRE = Lower Right Edge; URE Difference = Greater Value of URE - Lower URE Value; in the same child, in the period of hospitalization; ULE = Upper Left Edge; LLE = Lower Left Edge; Difference LLE= Largest Value of LLE- Lower value of LLE, in the same child, during the hospitalization period.

Source: Authors' data.

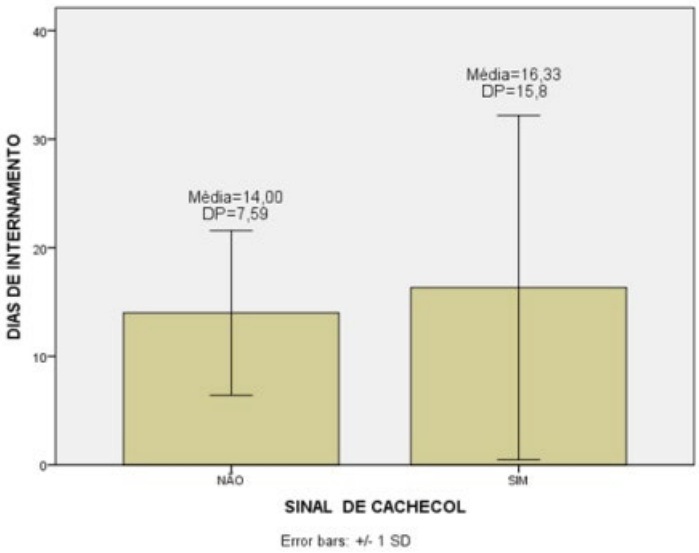
Table 4. Comparison between the scarf sign and the differences in the measurements of the scapular edges upper right and lower left in relation to the spine, of newborns admitted to an Intermediate Care Unit in a public hospital, Salvador, Bahia, 2019

Scarf Sign	Ure Difference	Lle Difference
No	0,26	0,48
Yes	0,35	0,32
P Value	0,414	0,366

URE Difference= Highest upper right edge value - Lowest edge value upper right, in the same child, during the period of hospitalization; LLE difference =Higher value of the lower left edge - Lower value of the lower left edge, at same child, in the period of hospitalization.

Source: Authors' data.

Graph 1. Comparison between the variables scarf sign and days of stay, of newborns admitted to an Intermediate Care Unit of a public hospital, Salvador, Bahia, 2019



Source: Authors' data.

Discussion

NBs admitted to special care units may show signs suggestive of scapular waist retraction. In this research, the presence of these signs was attributed to mobility abnormality of the complex scapular waist/upper limbs, caused by the alteration of the muscle tone or shortening, postural abnormalities demonstrated by the presence of shoulder abduction or scapular abduction and/or reduction of scapular medial edge measurements in relation to the spine, during the period of hospitalization until discharge.

In this study, two NBs, one low weight, and one very low weight at birth, showed signs of scapular waist retraction, the first obtained a scarf sign positive for hypertonia and the second progressive reduction of LLE scapular measures in relation to the spine, throughout the internment. This fact corroborates with the findings of Georgieff and Bembaum[10], who described in their study that the incidence of retraction scapular was associated with muscle tone abnormality around 46% (57/125 infants), of which 74% (42 infants) presented retraction associated with hypertonia. Also, these authors found that low birth weight, frequency of pathologies respiratory and the longer period of hospital stay were predisposing factors to scapular adduction.

According to Abelha et al.[16], more severe patients who needed surgical procedures could have a prolonged hospitalization stay, due to the reserved prognosis or poor clinical evolution, which corroborates with the results of this study, since, the only patient who underwent surgery stayed longer than 40 days in the ICU. Sweeney and Gutierrez[5] described that a longer period of hospitalization is one of the main predisposing factors to the appearance of postural alterations, due to the greater time in static positions, bedside restrictions or insufficient mobilizations. The results of this study showed that the greatest number of days of hospital stay is linked to the suggestive signs of scapular retraction, agreeing with the authors' data mentioned above.

Monterosso et al.[6] recommended in their study that inappropriate positioning routines can favor a greater activation of the trunk extensor musculature and, consequently, scapular retraction, associated with shoulder abduction, which can contradict the upper limbs functional development of the behavior to the middle line. According to Monfort and Smith[3], the risk to the development of these posture changes can be related, mainly, to the permanence of the NB in any position, for a long period.

According to Sweeney and Gutierrez[5], newborns who remain in restricted positions with prolonged pressure in the joints, and consequent minimum refinement of the mechanoreceptors, are more vulnerable to skeletal deformation, muscles shortening and reduction of joint mobility, factors that may predispose to the scapular adduction. This corroborates with the results obtained, since, neonates who obtained muscle shortening of the trapezium (middle portion), rhomboids and pectoralis, with reduction of the mobility scapular waist/upper limbs complex, demonstrated by the scarf sign positive, presented one of the signs suggesting scapular retraction.

Therefore, it can be verified that the time of hospitalization factor should not be considered the only one responsible for the appearance of postural alterations and suggestive signs of scapular waist retraction in NBs. Other factors are associated, such as bad positioning[2], bed restriction, inadequate care practice[5,6] and post-operative thoracic surgeries or abdominals, for favoring the supine position, a position associated with the appearance of shoulders retraction, abduction and external rotation of upper and lower limbs[17]. Doureta et al.[18] described that the lack of functional bed positioning can also favor external rotation and hip abduction, and can compromise the movements of lower limbs and lead to possible future orthopedic deformities.

According to Byrne and Campbell[19], the maintenance of scapular retraction associated with external rotation of the shoulders can be harmful if the appropriate therapeutic approaches have not been adopted. Sweeney and Gutierrez[5] described that these postural changes may lead to limitations for ranges and rolling. Activities such as crawling, manipulating, transferring objects and support their own weight in the forearms in ventral decubitus may also be hindered by the presence of these changes[6,10].

In addition, Giachetta et al.[20] verified that the impact of the hospital environment and time in that NBs remain hospitalized are possible risk factors for delay in development, due to sensory hyper-stimulations, excessive handling, painful interventions and continuous sleep/wake cycle interruptions.

It is important to note that the presence of pain among NBs, especially among those hospitalized, submitted to mechanical ventilation is not uncommon. A study that evaluated 22 NBs premature infants, with gestational age less than or equal to 32 weeks, admitted to a Neonatal Intensive Care Unit (NICU), verified that those critically ill submitted to IMV presented some physiological and behavioral responses of pain[21].

Some scales that have the objective of evaluating the responses to painful sensations, such as the modified ATTIA scale[21] and the newborn's pain and discomfort scale, Échelle Douleur Inconfort Nouveau-Né (EDIN)[22], presents the muscular hypertonia among your rating items. Therefore, it can be assumed that prematurely born children hospitalized in a critical state, submitted to VMI, have a high risk of presenting an associated algic chart[21] and a greater vulnerability to develop signs suggesting scapular waist retraction, due to the presence of hypertonia[10]. However, the sample of the present study did not understand these characteristics.

This study is a pioneer, innovative in the area of Neonatal Physiotherapy, being the first record in this population observing postural changes and their relationship with quantitative measures, even if without predictive value, which makes the production a stimulus for new research.

It is expected that the results found may alert the multi-professional team acting in the neonatal units on the prevention or early detection of possible postural changes that may pose risks to the functionality and delays in development, thus how, to encourage better quality assistance. The professional physiotherapist as a member of this team must be able to carry out preventive measures and/or interventions that reduce the impacts of hospitalization.

The present limitations in this research refer to the methodological difficulties in scapular measurement because no validated measuring instrument has been identified in the literature or a reference value of the normality limit for this change, which made it difficult to evaluate performance, mainly due to the fact that the study is composed of a heterogeneous population in relation to gestational age, weight gain, height and muscle tone development. In addition, the study relied on a small number of samples, which limits the statistical power.

Therefore, future studies that address the development of validated tools for the identification of scapular waist retraction is of great importance, since the early identification of factors that may cause developmental delays is fundamental for prevention and/or treatment, aiming at an adequate development.

Conclusion

This study has shown that suggestive signs of scapular waist retraction were present in almost half of the sample. No correlation was found between the positive scarf sign and the differences in the RUE and LLE measurements of the scapulas in relation to the column. But those NBs that showed positive scarf sign for mobility reduction of the scapular waist/upper limbs complex, and or scapular reduction of LLE measures in relation to the spine, presented a greater variation of days of hospitalization, which refers to the maximum values achieved. This characteristic is evidenced in the participant who simultaneously presented the set of suggestive signs of scapular waist retraction, positive scarf sign, shoulder abduction, scapular adduction, and reduction of the scapular measures in LLE. It is important to note that these findings translate the characteristics of the specific population in this study, considering their limitations.

Authors' contributions

Albergaria TFS participated in the conception, design, searches, data collection, interpretation of the results, writing of the research, revision, contribution to the final version and forwarding of the scientific article. Gomes IML participated in the conception of the research, assisted in data collection and review. Villa Flor CJDR assisted in the conception, collection of data, revision and contribution to the final version. Pinto Júnior EP participated in the conception, statistical analysis of survey data, interpretation of results, review and contribution for the final version. Gomes JS participated in the conception, design, searches, collection of data, interpretation of results, writing the survey, review and contributions to the version end of the scientific article.

Conflicts of interest

No financial, legal or political conflict involving third parties (government, companies and private foundations, etc.) has been declared for any aspect of the work submitted (including, but not limited to, grants and funding, board membership consulting, study design, manuscript preparation, statistical analysis, etc.).

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