

# Original

## Goniometric Analysis of Affected Joints in Axillary ,Inguinal or Ilioinguinal Lymphadenectomies for the Treatment of Cutaneous Melanoma

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### Abstract

**Objectives:** The objective of this study is to compare the joint range of motion (ROM) reduction between the submitted limb to lymphadenectomy and contralateral and to evaluate if ROM restriction is also connected with lymphedema. **Materials and Methods:** Evaluated were 84 patients submitted to axillary lymphadenectomy (n=40), inguinal (21) or ilioinguinal (23) for the treatment of cutaneous melanoma, operated between 1990 and 2008. Individuals excluded were those with amputation of a limb or bilateral dissection that would make perimetry and goniometry comparison impossible. The invited patients were submitted to goniometric evaluation of the shoulder or hip and measurement of the upper or lower limbs through manual perimetry. **Results:** The difference of 4.2 degrees between the averages of ROM flexion (p=0.005) of the shoulder of the affected side in relation to the control, and 5.2 degrees in abduction (p=0.002) were sufficient to be statistically significant, with the exception of 3 degrees of external rotation (p=0.135). The differences between the means of hip ROM were also significant, varying 8.5 degrees in flexion (p <0.001) and 2.2 degrees in abduction (p=0.011). The ROM of the shoulder or hip of the affected side did not present differences between the 33 patients with lymphedema in relation to the 51 patients without lymphedema: shoulder with flexion (p=0.148), abduction (p=0.577) and external rotation (p=0.866); hip with flexion (p = 0.665) and abduction (p=0.795). **Conclusion:** In spite of individuals with lymphadenectomy show restriction of joint ROM in flexion and abduction of the shoulder and hip in the late postoperative period, there was no association between joint ROM, of the shoulder on both the hip and the presence of lymphedema.

**Keywords:** Articular goniometry, Lymphedema, Melanoma, Lymphadenectomy

### Introduction

Cutaneous melanoma is a malignant disease originating from melanocytes, responsible for skin coloration, with elevated rates of mortality and an increase in worldwide incidence around 6% per year.<sup>1</sup> Its treatment is surgical, where a removal of the tumor and investigation of lymph node metastasis is done. When metastases are noted, radical lymphadenectomy is performed.<sup>2</sup> However, this procedure can lead to a series of complications such as lymphedema and joint range of motion alterations.

Lymphedema is a chronic disorder where an

accumulation of protein-rich fluid takes place with subsequent inflammation, hypertrophy of adipose tissue and fibroses.<sup>3</sup> It is considered the most common morbidity after lymphadenectomy, both axillary and inguinal.<sup>4-9</sup>

Very little has been studied in relation to joint range of motion(ROM) restriction resulting from lymphadenectomies for the treatment of cutaneous

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melanoma. ROM restriction is something that reverberates in the quality of life of the patient, causing difficulties in certain activities of daily life.

The objective of this study was to evaluate ROM restriction after lymphadenectomy and if there is an association between ROM and the presence of lymphedema.

## Materials and Methods

Eighty-four patients were evaluated who were submitted to axillary, inguinal or ilioinguinal lymphadenectomy as part of cutaneous melanoma treatment between 1990 and 2008 and who had undergone surgery more than six months prior. Excluded were patients who did not agree with the terms of the consent, who had an amputation of a limb or bilateral dissection, making volume comparison between the limbs impossible. The project was approved by the Ethics Committee of Hospital A.C. Camargo.

Manual perimetry was used through a tape measure to obtain the diagnosis of lymphedema in the upper or lower limb. In the upper limb, the first measure was made from the interarticular line of the elbow, then 7 to 14 cm above and then 7, 14 and 21 cm below this.<sup>10</sup> Measurement was made in the lower limb each 10 cm starting from the calcaneus until the seventh measurement.<sup>11-12</sup>

The encountered data were put in the formula to find the volume of a frustum (truncated cone with parallel apex and base):  $V = h (C1^2 + (C1 \times C2) + C2^2) / (12 \times \pi)$ , where  $V$  = final volume of the limb segment;  $C1$  and  $C2$  = circumferences between the measured points;  $h$  = distance between the circumferences ( $C1$  and  $C2$  in each segment), calculated in centimeters.

The definition of lymphedema of the upper limb was a difference greater than 10% between the volumes of the two limbs,<sup>6,13-15</sup> and above 6.5% for lower limbs.<sup>5,14</sup> The values for upper and lower limbs were based on the volume by water displacement, since no studies were found which gives a value for the diagnosis of lymphedema based on limb volume through a frustum.

Joint ROM of the limbs was obtained through a CARCI® manual goniometer (Carci Ind. & Com. Ltda., São Paulo, Brazil), which is a plastic instrument with two arms; one fixed and one moveable that accompanies the arch of movement. Goniometry (measurement technique) was always done by the same investigator, orientating the patient so that the movement was made freely. ROM restriction was defined as a difference greater than 10

degrees of an affected limb to the contralateral.<sup>16</sup>

Goniometry of the glenohumeral<sup>17</sup> and hip joints<sup>18</sup> were schematized. For glenohumeral flexion in orthostatic position (0 to 180°), the arm was elevated in front with the palm of the hand medially parallel to the sagittal plane, while for abduction (0 to 180°) the limb was laterally elevated with the thumb pointing up. External rotation of the shoulder (0 to 90°) was made in dorsal position while lying on an examination table, with the back of the hand pointing in the direction of the ground. For hip goniometry, flexion (0 to 125°), in lying position on examination table, was made with knee flexed with approximation of the thigh to the abdomen, while abduction (0 to 45°) was made with the opening of the lower limb analyzed in relation with the other.

ROM difference between the right and left limbs was calculated through the comparison of means using paired t test. The association between the presence of lymphedema and ROM restriction was evaluated by Mann-Whitney U test. Adherence to normality was verified through the tests Kolmogorov-Smirnov and Shapiro-Wilk. In all statistical tests, the significance level was set at 5% ( $\alpha = 5\%$ ).

## Results

Eighty-four patients were evaluated, 40 (47.6%) with axillary lymphadenectomy, 21 (25%) with inguinal lymphadenectomy and 23 (27.4%) with ilioinguinal lymphadenectomy. The mean time elapsed from lymphadenectomy was 44 months, with a standard deviation of 56.1 (ranging from 6 months to 17.6 years).

The prevalence of lymphedema in upper limbs was 17.5% and 59.1% in lower limbs (42.9% and 73.9% in lymphadenectomies inguinal and ilioinguinal, respectively). Most lymphedemas were light (66.7%) and the remainder moderate (33.3%).

The mean age of the surgery patients was 47.2 years, with standard deviation of 16.7 (ranging from 5 to 80 years). The mean age on the day of evaluation was 52.5 years, with standard deviation of 16 (ranging from 10 to 81 years). Three individuals with less than 18 years (3.6%) participated in the study.

Anterior shoulder flexion ROM on the side affected in relation to the control presented statistically significant difference ( $p=0.005$ ). The same occurred for abduction ( $p=0.002$ ) (Table 1).

The differences between hip flexion and abduction

**Table 1** - Range of motion difference of the shoulder joint (in degrees) of the upper limb affected as control in axillary lymphadenectomy

Range of motion (degrees)				
Movement		Affected member	Control member	P value
Flexion	Mean	162.5	166.7	0.005
	Standard deviation	13.7	12.0	
Abduction	Mean	165.1	170.7	0.002
	Standard deviation	13.3	9.9	
External rotation	Mean	79.7	82.7	0.135
	Standard deviation	13.8	12.5	

of the side affected to the control in inguinal and ilioinguinal lymphadenectomies were statistically significant ( $p < 0.001$  and  $p = 0.011$ , respectively) (Table 2).

The ROM, both in the shoulder and the hip of the side of the lymphadenectomy, did not present statistically

**Table 2** - Range of motion difference of the hip joint (in degrees) of the lower limb affected as control in inguinal or ilioinguinal lymphadenectomy

Range of motion (degrees)				
Move-ment		Affected member	Control member	p value
Flexion	Mean	89.9	98.4	< 0.001
	Standard deviation	23.5	17.8	
Abduction	Mean	42.2	44.4	0.011
	Standard deviation	5.0	2.7	

significant differences between the patients who had or did not have lymphedema (Table 3).

When related to post-operative morbidities, such as infection of the surgical site, wound dehiscence, seroma and cutaneous insensitivity, and to the ROM of the limb submitted to lymphadenectomy, there was difference only in the flexion of the lower limb, where the patients who had wound dehiscence presented a ROM reduction when compared to those who did not present this fact ( $p = 0.019$ ).

**Table 3** - Range of motion difference (in degrees) of patients who presented or did not present lymphedema conforming to perimetry of the upper and lower limbs, ipsilateral and lymphadenectomy

Movement		Range of motion (degrees)		
		Without lymphedema	With lymphedema	P value
Flexion of upper limb	Mean	164.2	154.9	0.148
	Standard deviation	12.0	18.8	
Abduction of upper limb	Mean	166.1	160.7	0.577
	Standard deviation	11.9	19.2	
External rotation of upper limb	Mean	79.4	81.4	0.866
	Standard deviation	13.9	14.1	
Flexion of upper limb	Mean	87.5	90.0	0.665
	Standard deviation	19.1	20.6	
Abduction of upper limb	Mean	42.9	42.7	0.795
	Standard deviation	4.9	5.1	

## Discussion

The present study presented some limitations. Of interest would be a prospective study of the patients analyzing the preoperative and recent post-operative joint movements, later analyzing which patients needed physiotherapeutic treatment for ROM gain. However, a prolonged study greater than ten years would be needed, since the number of patients with melanoma is relatively low when compared with other tumors, and because of its highly aggressive nature, many deaths would result within a short period of time.

Another factor is the difference of post-operative time among patients, since some had not completed a year, while others had any more than ten years, with the surgical treatment of melanoma undergoing changes along the 18 analyzed years.

Joint restrictions can be related to lesions of nerve rami, both in the axilla and in the thigh, since the surgeries were carried out by different teams and, very probably, without the same protocols.

The ROM, both in the shoulder as the hip, did not

present considerable difference in patients who had or did not have lymphedema, which leads us to believe that this is not a factor that contributes to ROM restriction.

All ROM means of the affected upper and lower limbs had a small difference when compared to patients who had or did not have lymphedema. In flexion and abduction of the affected upper limb and in the abduction of the affected lower limb, the mean was greater in patients without lymphedema. In the external rotation of the affected upper limb and in the flexion of the affected lower limb, the mean of this ROM were greater in patients with lymphedema.

In axillary lymphadenectomy, independent the patient had or did not have lymphedema, a greater ROM restriction was noted of the shoulder joint in the movements of flexion and abduction. The same movements also presented ROM restriction in the hip joint on the side of the inguinal or ilioinguinal lymphadenectomy in relation to the control. Wound dehiscence was the only post-operative morbidity responsible in contributing in ROM reduction, valid only for lower limb flexion.

The interesting thing is that even though late, some patients presented ROM alteration. Probably, this occurred due to the non-realization of post-operative physical therapy. The restriction of joint movement after lymphadenectomy is considerable, but if exercises for ROM gain are made, this restriction can be restored totally or sufficient enough so that it does not damage the functionality of the limb.<sup>19</sup>

In the studies of Vries<sup>5-6</sup> and Langer,<sup>20</sup> ROM restriction was considered as a difference of more than 20 degrees of the joint on the affected side in relation to the contralateral. Helms<sup>16</sup> considers ROM restriction difference starting from 10 degrees, which was employed in this analysis.

To consider 10 degrees or 20 degrees for ROM restriction is somewhat complicated, since flexion and abduction of shoulder joint ROM is from 0 to 180 degrees, whereas external rotation is from 0 to 90 degrees. This value presents a still greater divergence between hip joint ROM, since ROM in flexion is from 0 to 125 degrees and abduction is from 0 to 45 degrees. A variation of 10 degrees or even one of 20 degrees in hip abduction can be very large if compared to shoulder flexion or abduction.

In the present study, the variations of 4.2 degrees on the side affected to the control in shoulder flexion and 5.6 degrees, also in the abduction of the shoulder joint, were sufficient to be statistically significant. However, 3 degrees of difference did not show statistical signification

in external rotation of the shoulder.

In the hip joint, flexion of the side affected in relation to the control had a difference of 8.5 degrees, which was statistically significant (<0.001), as well as abduction with a difference of 2.2 degrees (0.011).

## Conclusion

Axillary lymphadenectomy was responsible for a restriction of joint movement in shoulder flexion and abduction of the upper limb affected in relation to the control and also in the flexion and abduction of the hip in inguinal and pelvic lymphadenectomies.

There was no association between joint range of motion, both for the shoulder and the hip, and the presence of lymphedema, since most of the patients had light lymphedemas, and in a lesser proportion, moderate lymphedemas.

It is of extreme necessity that more studies are carried out to evaluate the damage that lymphadenectomies can cause in the joints affected by surgical procedures.

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