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Evaluation of the Clinical and Electrophysiological Impact of Cervical Lymph Node Curage on the Function of Accessory Spinal Nerve Xi

Yazidi M[1]*, Kabil A[1], Dades R[1], Beloui R[1], Boutalja H[1], Kyal N[1], Lmidmani F[1], El Fatimi A[1], OukessouY[2], Bijou W[2], Lita Z[2], Zyouti M[2] and Mahtar M[2]

[1]Department of Physical Medicine and Rehabilitation CHU Ibn Rochd, Casablanca, Morocco

[2]Department of Otorhinolaryngology and Head and Neck Surgery, Morocco

ABSTRACT

The most frequent complication of neck dissection is the spinal accessory nerve injury, particularly during level IIb dissection. The objective of our work is to assess the impact of this surgery on the function of the spinal accessory nerve, as well as to determine the risk factors associated with nerve lesions and to propose suitable rehabilitation strategies.

We conducted a prospective study in the Physical Medicine and Rehabilitation Department at the Ibn Rochd University Hospital in Casablanca, in collaboration with the Otorhinolaryngology Department. The study included 29 patients (50 neck dissections) who underwent cervical lymph node dissection between January 2023 and December 2023 and were followed up in our department for 6 months after the operation. We included in this study all patients who had undergone cervical lymph node dissection, regardless of the initial indication. The analysis focused on clinical evaluation and electromyography (EMG) to identify alterations in the spinal accessory nerve and to identify factors influencing the evolution. These results indicate that neck dissection, particularly level IIb, may lead to significant neurological repercussions. These complications may disrupt patients' quality of life, raising the question of the necessity of such an intervention in certain clinical indications. Although spontaneous clinical improvement is often observed, rehabilitation can play a crucial role in managing patients, helping to mitigate the effects of these residual effects. A reevaluation of surgical practices may also be necessary to balance oncologic efficacy and patients' well-being.

***Corresponding author**

Yazidi M, Department of Physical Medicine and Rehabilitation CHU Ibn Rochd, Casablanca, Morocco.

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Introduction

Cervical lymph node dissection plays a central role in the treatment of head and neck cancer, particularly in the management of lymph node metastases. This surgical procedure aims to remove lymph nodes from the neck to reduce the tumor burden, limit metastatic spread and improve patients' prognosis. In addition to its therapeutic role, it also provides an accurate assessment of lymph node status, which is essential for tumor staging and guiding subsequent treatment strategies [1]. In our context, where Morocco is an endemic country, lymph node dissection is also indicated in cases of lymph node tuberculosis resistant to medical treatment.

However, cervical lymph node dissection is not without risks, particularly in terms of vascular and neurological lesions. The anatomical structures of the neck, such as the accessory spinal nerve, the internal jugular vein and the sternocleidomastoid muscle, are frequently exposed during this operation [2,3]. The accessory spinal nerve is often vulnerable because of its proximity to the targeted ganglion territories, particularly those in the retro spinal area (IIb) (Figure 1). The spinal nerve plays a fundamental role in the innervation of the trapezius and sternocleidomastoid muscles. Its integrity is essential for shoulder function, particularly in stabilizing the scapula. Any damage to the spinal nerve can result in muscle weakness, limited range of movement of the shoulder and chronic pain, compromising patients' quality of life and their ability to carry out daily activities [3,4]. The clinical impact of these accessory spinal nerve injuries highlights the need to identify the associated risk factors and develop effective prevention and rehabilitation strategies. It is also crucial to compare the results observed with existing data in the literature in order to determine the best practices for minimizing post-operative complications.

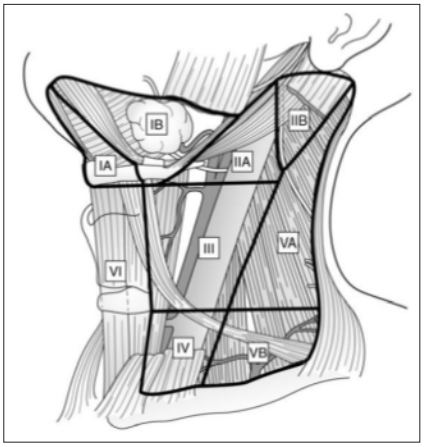

Figure 1: Lymph Node Groups [3]

The aim of this study is to assess the impact of cervical lymph node curage on accessory spinal nerve function in the short and medium term, to identify the risk factors associated with damage to this nerve and to propose optimal rehabilitation strategies for patients with shoulder dysfunction.

Materials and Methods

We conducted a prospective study in the Physical Medicine and Rehabilitation Department at the Ibn Rochd University Hospital in Casablanca, in collaboration with the Otorhinolaryngology Department. The study included 29 patients who underwent cervical lymph node dissection between January 2023 and December 2023 and were followed up in our department for 6 months after the operation. Informed consent was obtained from all individual participants included in the study. We included in this study all patients who had undergone cervical lymph node dissection, regardless of the initial indication. We excluded from the series patients with a history of pathology of the shoulder and cervical spine, those who had received adjuvant radiotherapy before the initial assessment of shoulder function, and those with incomplete medical records.

Nerve function was assessed at 1 and 6 months post-operatively, by means of a clinical examination including testing of the Sternocleidomastoid (SCM) and trapezius muscles, assessment of their trophicity, assessment of scapular mobility, measurement of shoulder joint amplitudes using a goniometer, and investigation of sensitivity disorders in the upper limb. The clinical examination was supplemented by an electromyogram (at 1 month and 6 months) to measure motor nerve conduction of the accessory spinal nerve. The parameters studied included latency in Milliseconds (ms) and the amplitude of the muscle action potential in millivolts (mV). We considered a latency of less than 3 ms to be the threshold of normality, while motor amplitudes were considered adequate above 5 mV [5]. Following the initial assessment, a rehabilitation protocol was prescribed for all patients, adapted to the impairments identified. Data was entered using Excel (2016). The Mann-Whitney test was used to assess the influence of different factors on the clinical picture and EMG results. The Wilcoxon signed ranks test and the McNemar test were used to monitor changes in clinical and paraclinical parameters. Finally, a linear regression analysis was used to examine the factors influencing the evolution of EMG results. Statistical significance was defined at a P value < 0.05.

Results

The average age of patients was 60, with extremes ranging from 16 to 90. The age group between 60 and 80 was the most prevalent, accounting for 48.3% of cases. 93% of patients were right-handed. Our study sample consisted of 29 patients (50 curages), including 6 women and 23 men. Participants underwent cervical lymph node dissection either for tumour pathology (82.76%) dominated by laryngeal cancer (66.7%), for infectious pathologies such as lymph node tuberculosis (10.34%), or for isolated adenopathies with no obvious cause (6.9%). Prior to surgery, patients with malignant tumour pathology were clinically and scannographically staged according to tumour size or invasion. In this sample, 12.5% of cases were classified as stage T1, 4.17% as stage T2, 54.17% as stage T3 and 29.17% as stage T4. 21 patients were operated on bilaterally, while the remaining 8 were operated on unilaterally. In total, the study included 50 cervical lymph node curages, of which 43 (86%) were lateral, including cervical areas II, III and IV. 6 (12%) were triangular, involving areas I, II and III. 1 (2%) was posterolateral (II-V). Other types of curage were also performed. We observed 3 parotid curages, associated with lateral and posterolateral curages. All the operators were right-handed. Monopolar forceps were used for each lymph node dissection. The thickness of the accessory spinal nerve was assessed intraoperatively. It was found that 47 nerves were thick, while 45 were bifurcated.

For the first evaluation at 1 month, the mean antepulsion amplitude was 140.80°, with a standard deviation of 41.38. The minimum amplitude observed was 60°. The mean abduction amplitude was 134.5° with a standard deviation of 45.28°. The minimum amplitude observed was 50°. For trapezius muscle strength, 72% had a testing score of less than or equal to 3/5 according to the MRC (Medical Research Council) score. For the SCM, 36% had a test score of less than or equal to 3/5. With regard to trophicity, 72% had amyotrophy of the clavicular head of the trapezius, while 30% had loss of relief of the SCM. Scapular detachment was observed in 32% of cases.

Hypoesthesia of the C2 territory was noted in 17 patients (34%), and hypoesthesia of the C3 and C4 territories in a single case (2%).

From a set of 50 sides assessed, the average latency observed was 2.78ms with a minimum of 0.926ms and a maximum of 9.24ms. 34% of cases showed rates above the 3ms threshold. With regard to action potential amplitudes, the mean amplitude was 3.04 mV, with a standard deviation of 1.61 mV. 84% of cases showed rates below the chosen normality threshold of 5 mV. Patients with malignant pathology showed a more marked decrease in amplitude (P = 0.026).

A second clinical examination was carried out six months after surgery. Only 22 out of 29 patients were followed up (4 patients lost to follow-up, 3 patients died), for a total of 39 cervical lymph node curages. The clinical and electromyographic course is shown in Table 1.

Table 1: Evolution of Clinical and Electromyographic Results.

Clinical exam / EMG	Results (1 month)	Results (6 months)	Evolution (P-value)	Signification
Antepulsion	Mean Amplitude : 147.05°	Mean Amplitude : 170.38°	0.00062	Significant improvement
Abduction	Mean Amplitude : 141.92°	Mean Amplitude : 167.69°	0.00062	Significant improvement
Muscle strenght trapezius	Mean strength : 3	Mean strength : 4	0.0002	Significant improvement
Muscle strenght SCM	Mean strength : 4	Mean strength : 4	0.00053	Significant improvement
Trapezius trophicity	71.8%	30.8%	0.00016	Significant improvement
SCM trophicity	30.8%	7.7%	0.0066	Significant improvement
Scapular winging	35.9%	23.08%	0.43	No significant improvement
Sensitivity dysfonction	38.5%	5.1%	0.00031	Significant improvement
Latency (EMG)	Mean Latency :2.5 ms	Mean Latency :2.à » ms	0.030	Significant improvement
Amplitude (EMG)	Mean Amplitude : 2.66 mV	Mean Amplitude : 4.32 mV	0.004	Significant improvement

Discussion

Data on patient age in the literature were relatively homogeneous. Although mean ages and age ranges varied slightly from one study to another, the samples were broadly comparable.

Our sample was predominantly male. This was observed in all the studies compared. It may be attributed to the greater frequency of head and neck cancers in men, who represent the main indication for lymph node dissection [6,7,9].

In our study, cancers of the larynx (66.7%) predominated over cancers of the oral cavity (12.5%). This is in marked contrast to other studies, where cancers of the oral cavity were more frequent. The predominance of laryngeal cancers in our sample can be explained by the high prevalence of smoking in Morocco, the main risk factor associated with this type of cancer. Conversely, cancers of the oral cavity and pharynx were more common in Western countries, where the combination of alcohol and smoking is more widespread and constitutes a major risk factor for these cancers. Our analysis also revealed that 10.34% of our cases had lymph node tuberculosis. This particularity observed in our study was closely linked to the epidemiological context in Morocco. According to the World Health Organization, nearly 35,000 people were affected by tuberculosis in Morocco in 2022 [7-13].

However, the most frequent neurological complication associated with selective lymph node curage remains damage to the accessory spinal nerve. The study by Chiesa-Estomba et al specifically explored the complications of selective cervical lymph node curage in a sample of 131 patients, totalling 200 curages. Their distribution showed that the majority of curages were lateral (65.5%), followed by anterolateral (14.5%), triangular (13%) and posterolateral (7%) [14-16]. Our sample consisted of 29 patients who underwent a total of 50 cervical lymph node dissections. Of these procedures, a majority of 43 (86%) were lateral (covering areas II, III, IV), while 6 (12%) were triangular. The predominance of lateral lymph node curage in our sample is explained by the high proportion of laryngeal cancers among the cases studied. Conversely, triangular lymph node dissection, which targets lymph nodes in the subdigastric, spinal and submaxillary regions, is mainly used for cancers of the oropharynx, a less common tumour location in our sample [17,18].

In our study, we found that some patients who had undergone selective lymph node curage had limited shoulder function. To explain these results, we compared our data with those of other studies. The study by Lima et al aimed to identify the impact of curage on accessory spinal nerve function in two distinct groups. One group had undergone curage including the retrospinal lymph node area IIb, and the other had undergone combined curage of levels IIb and V. The results showed that 90% of cases who underwent curage of the nodes in area V had an abduction of less than 90°. In comparison, only 56% of cases with manipulation limited to level IIb had similar restrictions. These results corroborate our own, where 32% of cases had an abduction of less than 100°. This suggests that the extension of curage to level V had a more significant impact on the motor function of the shoulder [6].

In our study, 72% of cases showed atrophy of the trapezius muscle and 32% showed scapular dyskinesis after retrospinal lymph node dissection. These results were less severe than those of Lima et al, where 100% of cases showed muscle atrophy [6]. All cases had undergone curage of areas IIb or combined curage of areas IIb and V. In contrast, in the study by Celik et al, only 10% of cases showed signs of trapezius atrophy (Figures 2 and 3) [6,17].

Figure 2: Left Scapular Detachment Following Cervical Lymph Node Dissection. (Iconography from the physical medicine and rehabilitation department at CHU Ibn Rochd)

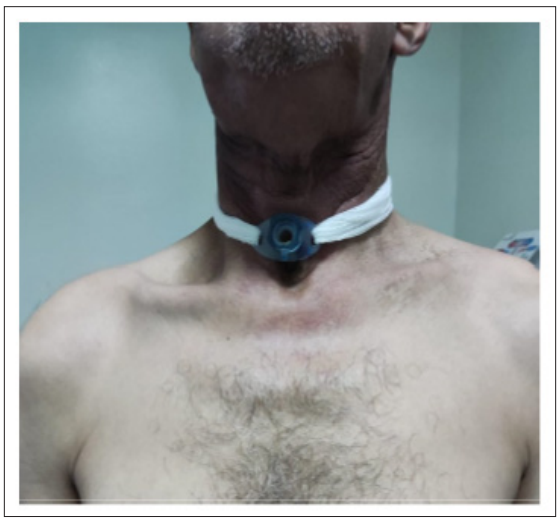

Figure 3: Atrophy of the Left Trapezius Muscle with Asymmetry of The Shoulder Girdle Secondary to Cervical Lymph Node Dissection. (Iconography from the Physical Medicine and Rehabilitation Department at CHU Ibn Rochd)

Conclusion

Our study demonstrated the significant impact of cervical lymph node curage on shoulder motor function, even when the accessory spinal nerve was anatomically preserved. We observed marked alterations in shoulder function, associated with axonotmesis as evidenced by the electromyogram. These results corroborate the data in the literature, highlighting the influence of retrospinal curage IIb and that of the ganglia of area V, located in the posterior triangle of the neck, where the risk of injury to the accessory spinal nerve is particularly high.

In the medium term, patients showed clinical improvement in shoulder function. However, persistent EMG abnormalities indicate that the neurological recovery process is often prolonged and requires ongoing monitoring. However, our study was limited by the relatively small sample size, which may have affected our ability to identify other relevant risk factors. In addition, the routine nature of retrospinal

curage in our department limited our ability to perform more nuanced comparative analyses. Early rehabilitation plays a fundamental role in the prevention of post-operative sequelae and in the optimal functional restoration of patients, thus contributing to a lasting improvement in patients' quality of life.

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Data Availability Statement: Data available on request from the authors

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