

Anterior approach to the cervicothoracic junction: case series and literature review

Acesso anterior das lesões da junção cervicotorácica: série de casos e revisão da literatura

Acceso anterior de las lesiones de la unión cervicotorácica: serie de casos y revisión de la literatura

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ABSTRACT

Objectives: the authors report their experience with the anterior approach to the cervicothoracic junction at C7 to T4 vertebral bodies, how the radiological investigation was performed in order to define the need for manubriectomy, how was the surgical pitfalls and the clinical evaluation. **Methods:** prospective cohort study with 14 patients who underwent an anterior approach to the cervicothoracic surgery during the period of January 1996 to January 2009. The patients underwent radiographic evaluation with computed tomography and magnetic resonance before surgery in order to identify when the manubriectomy was necessary. The surgery was usually performed from the left side through an anterior Smith-Robinson approach and manubriectomy when necessary. Mesh and cervical plate system were used for stabilization when corpectomy was performed. Nevertheless, in

RESUMO

Objetivo: relatar a experiência dos autores no acesso anterior da junção cervicotorácica C7 a T4, em relação à definição de quando é necessária a realização da manubriectomia, quais as particularidades desta cirurgia e a avaliação dos resultados. **Métodos:** estudo de coorte prospectivo com 14 pacientes tratados cirurgicamente de doenças da transição cervicotorácica durante o período de janeiro de 1996 a janeiro de 2009. Os pacientes foram avaliados no pré-operatório com tomografia computadorizada e ressonância magnética a fim de identificar em quais casos a manubriectomia seria necessária. A cirurgia foi realizada preferencialmente pelo lado esquerdo, utilizando-se a via de acesso anterior de Smith-Robinson e, se houvesse necessidade, combinado à abertura do manúbrio. Quando realizada a corpectomia, foram utilizados Mesh e placa cervical para estabiliza-

RESUMEN

Objetivo: relatar la experiencia de los autores en el acceso anterior de la unión cervicotorácica C7 a T4, en relación a la definición de cuánto es necesaria la realización de la manubriectomía, cuáles las particularidades de esta cirugía y la evaluación de los resultados. **Métodos:** estudio de cohorte prospectivo de 14 pacientes que fueron tratados quirúrgicamente de enfermedades de la transición cervicotorácica, durante el periodo de Enero de 1996 a Enero de 2009. Los pacientes fueron evaluados en el pre operatorio con tomografía computadorizada y resonancia magnética, a fin de identificar en cuáles casos la manubriectomía sería necesaria. La cirugía fue realizada preferiblemente por el lado izquierdo utilizando la vía de acceso anterior de Smith-Robinson y en caso de necesidad, sería combinado con una abertura del manubrio. Cuando realizada la corpectomía fueron utilizados Mesh y placa cervical para es-

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the cases with discal herniation C7-T1, the reconstruction was done with PEEK and cervical plate system. **Results:** the mean age was 63 years old (range, 30-77 years) and seven of the patients were men. The majority of cases had metastatic disease (n=8) or disc herniation (n=4). There were two complications related to the surgical procedures: one patient with dysphonia caused by a local hematoma and other one with lung infection. The mean surgical time, bleeding volume, pain intensity, medication intake and length of hospital stay were lower in the cases in which manubriotomy was not necessary. **Conclusions:** the anterior approach to the cervicothoracic junction is effective and presents low morbidity rate. In cases of injuries involving the C7 vertebral body and C7-T1 intervertebral disc herniation, a transcervical approach without the manubriotomy was indicated; when a T1 and/or T2 corpectomy was necessary, the transmanubrial approach usually was necessary in order to provide a good working space to perform a corpectomy and reconstruction. Performing manubriotomy increases surgical time, bleeding, pain intensity, analgesic drugs intake and the length of hospital stay.

ção, enquanto na cirurgia de hérnia discal C7-T1, a reconstrução foi feita com PEEK e placa cervical. **Resultados:** a média de idade foi 63 anos, sendo 7 pacientes do sexo masculino. A patologia mais comum foi a doença metastática (n=8) seguida pela hérnia discal C7-T1 (n=4). As complicações relacionadas ao procedimento cirúrgico foram duas: um paciente com disfonía causada por hematoma local e outro caso com infecção pulmonar. O tempo médio da cirurgia, o volume de sangramento, a intensidade da dor, a necessidade de medicação analgésica e o tempo de hospitalização foram menores nos pacientes nos quais a manubriotomia não foi necessária. **Conclusão:** o acesso anterior à junção cervicotorácica é um acesso rápido e de baixa morbidade. Lesões que envolvem o corpo vertebral de T1 ou o espaço discal de C7-T1 foram abordadas somente pela via cervical sem abertura do manúbrio. As lesões do corpo de T1 e/ou de T2 foram normalmente manejadas com a abertura do manúbrio a fim de se obter um adequado campo de trabalho para ressecção das lesões e estabilização. A abertura do manúbrio aumenta o índice de complicações, tempo cirúrgico, sangramento, intensidade da dor e tempo de internação.

tabilización, mientras que en la cirugía de hernia discal C7-T1 la reconstrucción fue hecho con PEEK y placa cervical. Resultados: la edad promedio fue de 63 años, siendo siete de sexo masculino. La patología más común fue la enfermedad metastásica (n=8), seguida por la hernia discal C7-T1 (n=4). Las complicaciones relacionadas al procedimiento quirúrgico fueron dos: un paciente con disfonía causada por hematoma local y otro caso con infección pulmonar. El tiempo promedio de cirugía, el volumen de sangramiento, la intensidad del dolor, la necesidad de medicación analgésica y el tiempo de hospitalización fueron menores en los pacientes en que la manubriotomía no fue necesaria. Conclusión: el acceso anterior a la unión cervicotorácica es un acceso rápido y de baja morbilidad. Lesiones que envuelven el cuerpo vertebral de T1 o el espacio discal de C7-T1 fueron abordadas solamente por la vía cervical sin abertura del manubrio. Las lesiones del cuerpo de T1 y/o de T2 fueron normalmente manejadas con abertura del manubrio a fin de obtener un adecuado campo de trabajo para la resección de las lesiones y estabilización. La abertura del manubrio aumenta el índice de complicaciones, tiempo quirúrgico, sangramiento, intensidad del dolor y tiempo de internación.

KEYWORDS: Cervical vertebrae/surgery; Thoracic vertebrae/surgery; Orthopedic procedures/methods; Magnetic resonance imaging; Tomography, X-ray computed

DESCRITORES: Vértebras cervicais/cirurgia; Vértebras torácicas/cirurgia; Procedimentos ortopédicos/métodos; Imagem por ressonância magnética; Tomografia computadorizada por raios X

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INTRODUCTION

The cervicothoracic junction is defined as the area extending from vertebral segments C7 to T4, and includes the lower brachial plexus, the thoracic outlet and the parenchymatous, vascular, lymphatic and nervous structures of the upper mediastinum. This region is a transition area from a mobile, lordotic cervical spine to a rigid, kyphotic thoracic spine¹. It is an area susceptible to injuries because of the weight transfer from the anterior to the posterior column²

and the vertebral index that decreases from C6 to T1 vertebrae³. Pathological processes such as tumors, trauma, degeneration and infection, which usually occur in the anterior segment of the vertebrae, frequently determine instability of this segment⁴. Progressive instability of this area ultimately leads to kyphosis and spinal cord compression, as neurological involvement is a common complication with rate as high as 80%^{4,5}. The indication of C7-T1 laminectomies to treat these lesions had two limitations; first, adequate ventral

spinal cord decompression is impossible and, second, the procedure itself can destabilize the cervicothoracic region, besides the fact that fixation is difficult⁶⁻⁸.

The surgical treatment goals are neural decompression, immediate stabilization, restoration of anatomical spinal alignment and early rehabilitation. Different surgical approaches to the cervicothoracic junction have been described^{1,4,7-29}. As most pathologies affect the anterior column, often an anterior approach is the best option that enables direct decompression and stabilization. The difficulty regarding the surgical technique resides in the cervicothoracic characteristics: narrowed operative field, bony obstruction by manubrium, clavicle and ribs and greater number of vital anatomical structures nearby, such as great blood vessels, esophagus, trachea, recurrent laryngeal nerve, thoracic duct and sympathetic ganglions.

In this paper, the authors report their experience with the anterior approach to the cervicothoracic junction, how the radiological investigation was performed in order to define the need for manubriectomy, the surgical pitfalls and their evaluation.

METHODS

Design and cases

The study is a prospective cohort of 14 patients with lesions in the cervicothoracic junction surgically treated by anterior surgical approach from January 1996 to January 2009. The indications for surgery were patients with unstable lesions of the vertebral bodies between C7 to T4, associated with ventral spinal cord compression. The exclusion criteria were: poor clinical conditions, low life expectancy in metastatic tumor disease, and refusal of surgery. The patients were evaluated preoperatively by computed tomography (CT) and magnetic resonance imaging (MRI) of the cervicothoracic junction with the patient in moderate extension of the cervical spine. The procedure was done by the same surgeons (AF, OR). The neurological presentation, the radiological features, the surgical data and the length of hospital stay were taken into account.

Radiological evaluation

The diagnostic evaluation was done by CT and MRI of the cervicothoracic junction with the patient in moderate cervical spine extension. The decision about the need for manubriectomy was defined by the sagittal images that had to include the manubrium and the cervicothoracic junction. The radiographic evaluation needed to address the following features (Figure 1):

1. the spinal cervicothoracic curvature;
2. the correlation between the superior border of the manubrium with the vertebral body to be resected;
3. the surgeons parallel view of the superior vertebral body plateau that will be resected until the vertebral canal is reached;
4. the location of the great vessels, such as the aortic arc, right brachiocephalic trunk and brachiocephalic vein;

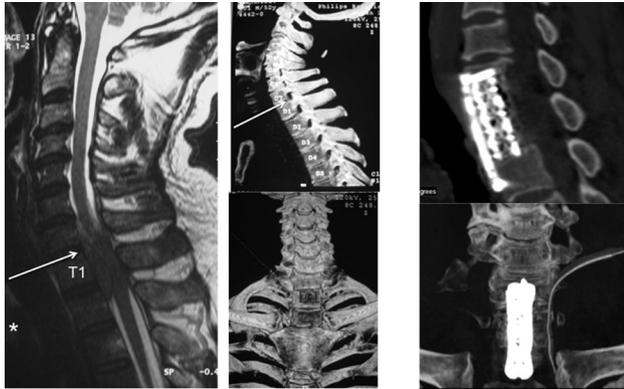


Figure 1
Radiographic features of which the surgeons should be aware in order to decide the best approach. (A) The upper level of the manubrium was parallel to the upper margin of T2 and the vertebral plateau had a slightly inferior inclination; (B) although the superior border of the manubrium was at T2, the manubriectomy become necessary due to the caudal displacement of cervicothoracic junction and the high position of the brachiocephalic arterial trunk (asterisk); (C) upper margin of the brachiocephalic arterial trunk during the surgery.

Indications for manubriectomy

The need to perform or not the manubriectomy depends on the level of vertebral lesion and the vertebral body inclinations, as the latter is the most important criterion. If a corpectomy was intended, a line was drawn parallel to the superior plateau of the vertebral body to be resected from the vertebral canal to a position anterior to the manubrium. This line represents the surgeon's operative view. If this line crossed above the superior border of the manubrium, a supramanubrial view, the manubriectomy was not necessa-

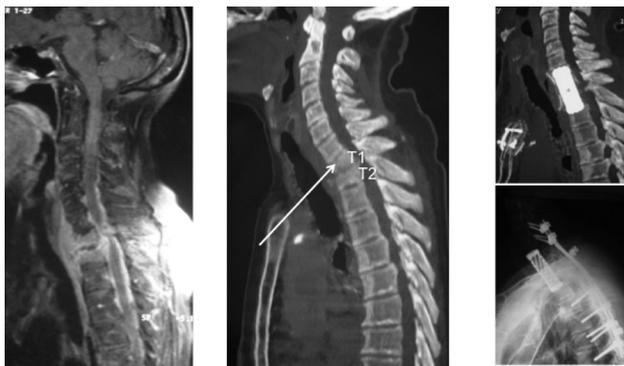
ry (Figure 2), otherwise, the manubriotomy was performed (Figure 3). If the patient had a disc herniation at the C7-T1 level, the surgeons' line of view was drawn parallel to the superior plateau of T1 from the vertebral canal to the manubrium. The manubriotomy was not necessary if the line crossed supramanubrially.



Case 8

Figure 2

The surgeon's supramanubrial view was parallel to the superior border of T1 (arrow), although the T1 vertebral body was above the superior border of the manubrium (asterisk). The manubriotomy was not necessary and a standard left cervical supramanubrial approach was performed (case 8).



Case 10

Figure 3

Although T1 and T2 vertebral bodies were above the supramanubrial border, the angle of the superior plateau of T1 did not allow the surgeons to visualize the vertebral canal from a supramanubrial view. In this case, manubriotomy was necessary (case 10).

Surgical procedure

The anterior approach to the cervicothoracic junction was done by left Smith-Robinson approach. The patient was placed in the supine position on the operating table under general endotracheal anesthesia. The neck was moderately extended by means of a folded sheet. Both wrists had traction bands applied to pull the arms down for lateral radiographic imaging during the procedure. Left vertical incision was performed along the medial aspect of the sternocleidomastoid to

the midline. If a manubriotomy was necessary, the skin incision extended along the midline of the sternum down two centimeters from the Louis angle (sternal angle). The sternomastoid, sternohyoid and sternothyroid muscles were sectioned, allowing a connection of the lower cervical region to the upper thoracic spine. A careful finger dissection was used to free the posterior tissue of the manubrium. After that, the bone was excised at midline using an oscillating saw until the sternal angle. When the manubriotomy was done, a small retractor was used to spread the manubrium borders. The level of dissection was confirmed by fluoroscopy. The lesion was removed using headlight and magnification. The reconstruction was done using a mesh and cervical plate system (Zephir, Medtronic). In the cases presented with disc herniation C7-T1, the reconstruction was done with polyetheretherketone (PEEK) and a cervical plate system. A suction drain was always left in the prevertebral space during 48 hours. Another suction drain was left at the substernal plane during five days in cases in which manubriotomy was performed. The sternum was closed with number three steel wires. The patients who underwent manubriotomy were kept in the intensive care unit for 48 hours, and then discharged to the hospital room. The suction drain was left at the substernal plane during five days. At the fifth postoperative day, they were allowed to sit with a cervical orthosis. The cases without manubriotomy could be discharged to the room around six hours after the procedure, the suction drain was maintained during at most 48 hours, and they were allowed to sit with a cervical orthosis 24 hours after the procedure. The patients were allowed to sit with a cervical orthosis on the second or fifth postoperative day, respectively, if the manubriotomy was not necessary or was performed.

Surgical evaluation

Recorded surgical variables are surgical time and transoperative bleeding. During the postoperative period, the incision pain intensity was assessed by the numerical rating scale, ranging from one (minimal pain) to ten (maximal pain) and the quantity of the analgesic medication intake was recorded. The hospitalization time was recorded as discharge to home.

Statistical analysis

All statistical analyses were performed with the software SPSS 16.0. Categorical variables were presented as number and proportion. Continuous variables were submitted to the Shapiro-Wilk test to verify normal distribution and presented as mean plus standard-deviation. In order to verify differences between the manubriotomy group and cervicotomy group, surgical time, bleeding, and length of hospital stay were compared through Student's t test.

RESULTS

During the last 13 years, 14 patients with anterior cervicothoracic lesions were treated by anterior approach. The mean age was 63 years old (range, 30-77 years old) and seven patients were males. The majority of the cases had metastatic disease (n=8) or disc herniation (n=4), and the initial symptoms were severe local pain in all cases, except one (case 4). The clinical and surgical features of the sample are summarized in Table 1.

TABLE 1 – Patient data

Case	Age/ Sex	Clinical manifestations	Level	Pathology	Surgical approach	Reconstruction	Surgical time (hours)	Bleeding (mL)	Postoperative VAS	Bleeding (mL)	Hospital stay (days)
1	65/F	Severe local pain Left cervicobrachialgia Strength grade III left C7 and T1	T1	Lung metastasis	Left cervicotomy and manubriotomy	Mesh and Plate	2.8	200	9	200	7
2	53/F	Severe local pain Bilateral cervicobrachialgia	T1	Thyroid metastasis	Left cervicotomy and manubriotomy	Mesh and Plate	3.2	220	8	220	8
3	68/M	Severe local pain Crural paraparesis grade III	T1-T2	Lung metastasis	Left cervicotomy and manubriotomy	Mesh and Plate	4.2	400	9	400	6
4	30/M	Crural paraparesis grade II	T1	Fracture and luxation at C7-T1	Left cervicotomy and manubriotomy	Mesh and posterior fixation	5.2	520	8	520	7
5	62/F	Severe local pain Bilateral cervicobrachialgia	T1-T2	Melanoma metastasis	Left cervicotomy and manubriotomy	Mesh and Plate	3.7	180	9	180	6
6	72/M	Severe local pain Bilateral cervicobrachialgia Strength grade III at T1	T1	Lung metastasis	Left cervicotomy and manubriotomy	Mesh and Plate	3.3	220	8	220	9
7	77/F	Severe local pain Crural paraparesis grade III	T2	Melanoma metastasis	Left cervicotomy and manubriotomy	Mesh and Plate	4.0	190	9	190	10
8	57/F	Severe local pain	T1	Lymphoma	Left cervicotomy and manubriotomy	Mesh and Plate	2.7	130	4	130	3
9	68/M	Severe local pain Left cervicobrachialgia Strength grade IV at right T1	C7	Melanoma metastasis	Right cervicotomy and manubriotomy	Mesh and Plate	3.1	220	5	220	7
10	80/F	Severe local pain Bilateral cervicobrachialgia Crural paraparesis grade II	T1-T2	Spondylodiscitis	Left cervicotomy and manubriotomy	Mesh and posterior fixation	3.8	310	10	310	28
11	46/M	Right cervicobrachialgia	C7-T1	Discal herniation	Left cervicotomy	PEEK and Plate	2.0	50	4	50	2
12	71/M	Left Cervicobrachialgia Strength grade III at left C8	C7-T1	Discal herniation	Left cervicotomy	PEEK and Plate	1.8	90	3	90	1
13	64/F	Left cervicobrachialgia Strength grade II C8	C7-T1	Discal herniation	Left cervicotomy	PEEK and Plate	2.3	80	3	80	1
14	70/M	Right cervicobrachialgia	C7-T1	Discal herniation	Left cervicotomy	PEEK and Plate	2.1	40	3	40	1.5

M: male; F: female

Indications for manubriotomy

The preoperative surgical planning, described in the methodology, on performing manubriotomy or not was always correct. In patients who needed a C7 corpectomy or a C7-T1 discectomy, the manubriotomy was never necessary; nevertheless, those cases in which T1 or T2 corpectomy was intended, the combination of cervical approach with manubriotomy was performed in all patients, except one.

Surgical procedure and evaluation

The patients who underwent manubriotomy had more surgical time, bleeding, and longer hospital stay than the patients who had a standard cervical approach. The mean surgical time was 3.75 hours (± 0.91) in the manubriotomy group and 2.00 hours (± 0.63) in the standard cervical group ($p=0.008$; mean difference between groups: 1.37 hours; CI 95%: 0.42-2.32). The mean difference in bleeding volume between groups was 178.33 mL ($p=0.007$; CI 95%: 57.52-299.13; manubriotomy= 280.00 ± 122.24 ; standard cervical= 101.66 ± 66.15). The manubriotomy group stayed in the hospital for 10.1 days on average (± 7.3), longer than the standard cervical group, that was in hospital for 2.5 days (± 2.3) ($p=0.032$; mean difference between groups: 7.62; CI 95%: 0.77-14.47).

The manubriotomy group reported higher pain intensity at the incision and needed more postoperative analgesic drugs. All patients demonstrated significant relief from preoperative pain and important neurological recovery. Case 4 and 10 were submitted to a posterior fixation of the spine because it was not possible to use an anterior plate, and the spinal instability was severe.

Complications

There were complications in two cases, in which manubriotomy was performed. One patient had a local hematoma that was diagnosed 72 hours after surgery, resulting in permanent dysphonia despite the rapid evacuation (case 10) and the other case with a lung infection (case 3).

DISCUSSION

Several surgical approaches to the cervicothoracic junction have been described in the literature. Posterior approaches are disadvantageous because of a destabilization effect, inadequate visualization of the vertebral body pathology, and the need for a long posterior construct to restore stability with a higher rate of complications than anterior or lateral approaches^{4,15,28,30}. These limitations maintain the further development of various posterolateral and anterior approaches^{4,8-26,29}.

The first description of a posterolateral approach in the cervicothoracic area was the costotransversectomy, described in 1894 by Ménard²². In 1954, Capener¹⁰ described the lateral rhacotomy approach, which provided a more extensive posterolateral exposure afforded by the resection of a longer rib segment. A modification of Capener's technique was described by Larson¹⁸ in 1976, which improved exposure and reduced morbidity. In 1991, Fessler et al.¹³

proposed the parascapular extrapleural lateral approach, which provides improved exposure of all the upper thoracic vertebrae. The disadvantages of this procedure are: prolonged surgery (10-12 hours), excessive blood loss and inefficiency for the pathologies extending into the C7 vertebrae¹⁵. Furthermore, lung-related complications are common after this approach³¹.

In 1957, Cauchoix and Binet¹¹ proposed an anterior approach combining the supraclavicular approach with a median sternotomy. This sternal splitting approach allows the exposure of the whole cervicothoracic junction up to T4^{16,24}. In 1960, Hodgson et al.¹⁴ reported a surgical mortality rate of 40% with the sternal splitting approach and recommended the anterolateral thoracotomy approach to the cervicothoracic junction, which had only 4% of mortality. However, the anterolateral thoracotomy approach provides limited access to the lower cervical spine because of the obstruction by the scapula and upper ribs. In 1985, Louis²⁰ improved the sternal splitting approach combining this procedure with the anterior Smith-Robinson approach²⁷, allowing access from C2 to T5¹⁶. In our experience, in lesions extending until the C7 vertebral body or C7-T1 intervertebral disc, we may have good exposure and working space with the supramanubrial cervicotomy. For treating the pathologies below T1, with a partial sternotomy (manubriotomy) we are able to reach T4, but not to achieve additional caudal exposure despite using a complete sternotomy, because of the limited retraction of the aortic arc¹⁵, and this procedure can minimize the risks of substernal dissection²¹. Upper lateral transthoracic or extrapleural approach is mandatory for total removal and reconstruction of the lesions of T4 and below¹⁵. Despite the high mortality reported by Hodgson et al.¹⁴ following an anterior surgical procedure to cervicothoracic junction, many authors^{8,12,15,16,21,23,24,26,29,32,33} believe that the direct anterior approach to the region is safe and effective, as demonstrated in our cases. We had only two complications: a local hematoma and a lung infection.

Many authors suggest a simple anterior supramanubrial cervicotomy to reach the anterior portion of the proximal dorsal vertebrae^{26,32,33}. Although this approach is not very invasive, it does not allow good visualization and anterior reconstruction below T1, which results from the patient's anatomical characteristics, such as marked junctional kyphosis, congenital high sternum, short neck or large shoulders^{7,15,24,34}. The need to perform or not the manubriotomy depends on the level of vertebral lesion and the vertebral body angulations, the latter variable being the most important. In order to minimize the vertebral body inclination, the cervical spine was moderately extended during the radiographic investigation and surgical procedure. In our experience, the manubriotomy was not necessary in cases in which C7 corpectomy or surgical removal of C7-T1 discal herniation were performed. These observations were also confirmed by Post et al.³⁵. It is important to make sure preoperatively when manubriotomy is really necessary, because the two complications observed in our series were both cases following manubriotomy. Furthermore, the surgical

time, transoperative bleeding, pain intensity, analgesic medication and hospital stay were higher in the manubriotomy group.

The indication of manubriotomy for patients who need T1 or T2 vertebral resection depends primarily on the superior plateau angulation of the vertebral body to be resected³⁴. The manubriotomy was not necessary if the surgeons' supramanubrial view was parallel to the superior plateau. Whenever this was observed, the T1 inferior plateau was above or at the level of the superior border of the manubrium (Figure 2). The opposite statement was not correct: "Whenever the vertebral body to be resected was above the superior manubrium border, the surgeon' view was parallel to his superior plateau" because it depended on the vertebral inclination, as demonstrated in the Figure 3. The inferior plateau did not necessarily have to be parallel to the surgeons' supramanubrial view, because after the corpectomy there would be enough space to decompress the vertebral canal and the distal osteosynthesis screw placements were oblique in an inferior and posterior direction, so that the manubrium will never become a disturbing factor.

The reconstruction was performed with mesh and cervical plates with excellent stabilization, since the posterior elements were normal. In two cases, the instability was severe and they had a supplementary posterior fixation. The cervical anterior plate must be narrow to fit in the cervicothoracic junction.

The anterior approach to the cervicothoracic junction requires accurate knowledge of the numerous anatomical structures that hinder this region. The right brachiocephalic vein runs vertically, joining the left brachiocephalic, or innominate vein, and coursing obliquely in front of the aortic arch behind the manubrium to form the superior vena cava at the level of the right second rib. The aortic arch limits this surgical approach to the length of T4-T5. It is oriented behind the lower aspect of the manubrium and left brachiocephalic vein. The brachiocephalic arterial trunk runs behind the manubrium. The recurrent laryngeal nerve arises from the vagus and courses around the subclavian artery on the right side and around the aortic arch on the left side. It traverses the operative field obliquely at a higher level on the right side; on the contrary, on the left side, it reaches the tracheoesophageal groove more caudally, having a vertical trajectory which is less liable to injury with left-sided exposure²⁴. Besides, the right nerve may not be recurrent from vagus in 1% of the patients and rise at a

higher level in the neck³⁶. To limit the risk of damaging the recurrent laryngeal nerve, we prefer performing the surgical approach on the left side. The only exception was case 9, in which the tumor extended to the right paravertebral side, so the cervical approach was to the right side. When the manubriotomy was performed, the suction drain had to be placed under the manubrium and maintained for five days in order to avoid a local hematoma. This complication occurred in case 10. Despite the urgent evacuation, the patient had a laryngeal nerve dysfunction with dysphonia.

Steinmetz et al.⁸ studied the factors associated with treatment failure in cervicothoracic junction surgery. In their large series of 593 patients, they reported treatment failure in 14 patients. Uninstrumented laminectomy and ventral multilevel corpectomies (two or three levels) across the cervicothoracic junction were associated with fusion failure in 38 and 16.7% of the sample, respectively. A trend toward treatment failure was reported in cases in which dorsal constructs ended at the C7 vertebrae, although it was not statistically significant. The authors recommended the supplemental dorsal instrumentation in cases of multilevel corpectomies, posterior instability or dorsal cervicothoracic laminectomies with extension of the dorsal hardware to T1 or T2. Besides, treatment failure was also associated with histories of prior cervical surgery, deformity correction and smoking. In cases 4 and 10, we performed an anterior decompression followed by a posterior stabilization because of posterior ligamentous and osseous instability.

CONCLUSION

The anterior approach to the cervicothoracic junction is a safe, effective and less destabilizing procedure, because it preserves the posterior osseo-ligamentous tension band. Preoperative radiological evaluation identified the cases in which manubriotomy was necessary. The performance of the manubriotomy increased the surgical time, transoperative bleeding, complications, pain intensity, analgesic medication intake and length of hospital stay. In our experience, injuries involving the C7 vertebral body and C7-T1 intervertebral disc herniation were treated with a standard cervical supramanubrial approach; when a T1 and/or T2 corpectomy was necessary, the parallel line through the superior plateau of the vertebral body to be resected suggests the need for the manubriotomy. The anterior reconstructions with mesh or PEEK combined with cervical plate were enough to keep the spine stable.

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