ORIGINAL ARTICLE

Surgical treatment in vascular injury by central vascular access

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Objective. **To describe the surgical approach used in vascular injuries caused by the placement of central access in the General Hospital of Mexico during the period of 4 years.** ***Material.*** **A series of cases was made in the general hospital of Mexico "Dr. Eduardo Liceaga", during the period from March 2016 to March 2019, where patients undergoing vascular repair were considered as a complication of central access.** ***Results.*** **A total of 18 patients were operated; the prevalence was female (61%), with an average age of 49 ± 10 years. The majority of patients were from the nephrology service (55.5%). The most frequent vascular access was right anterior jugular with 61%, deriving from this that the main vascular structure affected was the right subclavian vein with 44%.** ***Conclusions.*** **Central access is the very common procedure in the hospital units which are not exempt from complications and these are seen more frequently in teaching hospitals like ours, there are 4 types of surgical approach for their management presenting a good percentage of success including minimally invasive accesses such as VATS.**

Key words: **Central access; Mini-sternotomy; Thoracoscopy; Vascular lesion; VATS.**

Objetivo. **Describir el abordaje quirúrgico utilizado en lesiones vasculares ocasionadas por la colocación de accesos centrales en el Hospital General de México durante el periodo de 4 años.** ***Material.*** **Se realizó una serie de casos en el Hospital General de México "Dr. Eduardo Liceaga", durante el periodo de marzo 2016 a marzo 2019, donde se consideraron los pacientes sometidos a reparación vascular como complicación de accesos centrales.** ***Resultados.*** **Fueron un total de 18 pacientes operados; la prevalencia fue del género femenino (61%), con un promedio de edad de los pacientes de 49 ± 10 años. La mayor parte de pacientes fueron interconsultados del servicio de Nefrología (55.5%). El acceso vascular más frecuente fue Yugular anterior derecho con el 61%, derivando de esto que la principal estructura vascular afectada fue la vena subclavia derecha con 44%.** ***Conclusiones.*** **los accesos centrales es el procedimiento muy común en las unidades hospitalarias las cuales no se encuentran exentas de complicaciones y estas se ven con mayor frecuencia en hospitales escuela como el nuestro, se presentan 4 tipos de abordaje quirúrgico para su manejo presentando un buen porcentaje de éxito incluyendo accesos de mínima invasión tal como lo es la VATS.**

Palabras clave: Acceso central; Miniesternotomía; Toracoscopía; Lesión vascular; VATS.

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The placement of the central venous access is the most common procedure performed in critical patients with specific indications in different diseases. However, this procedure is not exempt from complications that increase morbidity and mortality as well as increase in-hospital length of stay and hospital costs. Health personnel involved at it must recognize, consider them and know how to manage them [1].

Vascular injury as a result of the placement of central venous accesses remain, although to a lesser extent potentially fatal, if not detected and managed in a timely manner, the highest incidence being in institutions where doctors are trained in postgraduate courses, as it is in our institution, requirements to acquire the necessary skills to perform these procedures more safely in daily practice.

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MATERIAL

A series of cases were carried out at our institution during the period from March 2016 through March 2019. Patients undergoing vascular repair were considered, which were admitted to the different units (internal medicine, nephrology

Table 1. Accessories used for the placement of central lines (n = 18)

	n	%
Right jugular vein	11	61
Left jugular vein	4	22
Right subclavian vein	3	17
Total	18	100

and emergencies) and that according to their condition they required clinically the placement of a central vascular access. For this study, demographic characteristics such as age, gender, clinical characteristics, characteristics of central catheters, site of puncture, affected vascular structure, surgical approach, resolution, complications and outcome of patients were considered.

RESULTS

A total amount of 18 patients operated on were collected for this study. The prevalence was female (61%), with an average age of patients 49 ± 10 years. Most patients were consulted in the nephrology department (55.5%).

The mostly used vascular access was the right anterior jugular vein (61%), followed by the left anterior jugular (22%) and finally the right subclavian access (17%) as seen in **Table 1**. Therefore, the main vascular structure affected was the right subclavian vein with 44%, and only in one case of the superior vena cava and brachiocephalic trunk (**Table 2**).

Considering the clinical characteristics, the diagnosis and the evolution of the patients, the surgical approach was decided. Right or left thoracotomy, according to the affected site, represented 38% of the cases followed by thoracoscopic access in 33% (**Table 3**). In all cases, it was repaired with a "U" teflon- pledgeted stitch using 4/0 or 5/0 polypropylene vascular suture.

Finally, we had a success rate of 94%, having one case of death due to respiratory complications not directly related to the surgical procedure itself.

Table 2. Location of vascular injury (n = 18)

	n	%
RSV	8	44
RJSJ	5	28
LSV	3	16
SVC	1	6
BCT	1	6
Total	18	100

RSV: Right subclavian vein, RJSJ: Right Jugular-Subclavian Juction, LSV: Left Subclavian vein, SVC: superior vena cava, BCT: Braquiocephlic trunk

Table 3. Surgical approaches (n = 18)

	n	%
Thoracotomy	7	38.5
Thoracoscopy	6	33.5
"J" miniesternotomy	3	17
Sternotomy	1	5.5
Cervicotomy	1	5.5
Total	18	100

DISCUSSION

Arterial injury occur in less than 1% of all those related to central access placement, arterial punctures occur in 4.2-9.3% [7].

Therefore, the use of imaging techniques such as ultrasound, reduce the incidence of complications from 11.8% to 4-7%. However, it does not eliminate the risk of arterial puncture [2,3,9].

When these complications occur, they may be immediate and/or late. The immediate complications occur at the time of placement and include vascular, cardiac, pulmonary complications and wrong position. Late complications include catheter dysfunction and infections [1].

These complications are related to the technique at the time of placement. The recognition and management of these complications is essential to offer an optimal treatment, such as vascular, cardiac, pulmonary complications and wrong location requiring surgical treatment for resolution [5].

Punctures with thick caliber cannulas can generate extrinsic airway obstruction due to the formation of cervical hematomas, hemothorax, pseudoaneurysms, arteriovenous fistulas and cerebral vascular events [5,6]. Arterial punctures are more easily recognized by pulsatile flow, although they remain difficult to detect in hypotensive patients and severe patients [4].

Arterial injuries are the most common, however, lacerations to the vena cava, mediastinal vessels and right atrium are also reported as demonstrated in our study. The entrapment of the guide in the walls of the vessel and the subsequent insertion of the dilator or catheter generate pressure on the vessel wall being the main mechanism of injury.

The options for surgical management range from direct repair of the perforation by simple suture to reconstruction with autologous tissue, bovine pericardium or synthetic graft. The synthetic graft is highly thrombogenic in the venous system and therefore requires anticoagulant treatment for 3 months [1].

Several surgical techniques have been used to improve the treatment of these complications, namely, anterolateral and posterolateral thoracotomy, conventional medium sternotomy, mini upper sternotomy, and video assisted thoracoscopic

surgery (VATS).

Different approaches have been described for minimally invasive thoracic surgery for diagnosis and treatment of thoracic pathologies (pulmonary, mediastinal, chest wall). Most of the procedures which are performed openly they also can be performed using small incisions on the thoracic wall by approximately 1 to 2 cm being assisted by video. They present relative contraindications and being the absolute one the impossibility of obtaining a reasonable space for working or not tolerating one-lung ventilation [11].

The superior mini-sternotomy is another approach which offers adequate exposure of superior mediastinal structures with adequate proximal control of the supraaortic vessels, superior vena cava and subclavian veins.

In our cases, a cervical approach is performed due to presenting the lesion in the right internal jugular vein. Nevertheless, no available information was found in the literature regarding this approach. So, even more evidence is needed to recommend this method.

In conclusion, four surgical approaches have been described in this work for the resolution of immediate complications of the central access placement, being posterolateral and / or anterolateral thoracotomy in a classical way. We also present two variations of minimally invasive approaches such as upper mini-sternotomy and thoracoscopic surgery, in which the reproducibility and efficacy of these approaches for the management of these complications is satisfactorily demonstrated having in our results an acceptable survival being 94% of our cases.

The use of thoracoscopy is recommended for lesions involving the subclavian vessels in their proximal portions, as well as the venous portion of the subclavian jugular junction and for the superior vena cava, as well as for the right atrium.

The superior mini-sternotomy approach offers easy access and adequate exposure of the proximal portions of the subclavian artery and vein, as well as the brachiocephalic trunk.

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