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# Short Communications

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Revista Colombiana de Ciencias Pecuarias

## Surgical placement and management of jugular vascular access ports in dogs and cats: description of technique<sup>a</sup>

*Implantación quirúrgica y gestión de catéter venoso central en la vena yugular de perros y gatos: descripción de la técnica*

*Implante cirúrgico e manejo de cateter venoso central na veia jugular de cães e gatos: descrição da técnica*

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### Summary

**Background:** vascular access ports (VAPs) are designed to allow repeated access to the vascular system with minimum patient distress. **Objective:** to describe the surgical technique, care and complications of jugular VAPs currently used at the Veterinary Oncology Service of the University of Florida Small Animal Hospital. **Conclusion:** the VAPs can remain in site for long terms (months) with minimum complications, and its placement is a reliable technique that should be considered by veterinarians, particularly for a long-term treatment.

**Keywords:** chemotherapy, intravenous access, medical oncology, vascular surgical procedures.

### Resumen

**Antecedentes:** los catéteres venosos centrales (VAPs) están diseñados para permitir el acceso repetido al sistema vascular con las mínimas molestias para el paciente. **Objetivo:** describir la técnica quirúrgica, atención de mantenimiento y las complicaciones de los VAPs en vena yugular, que se utiliza actualmente en el Veterinary Oncology Service en la University of Florida Small Animal Hospital. **Conclusión:** el VAP puede permanecer

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en el lugar durante periodos largos (meses) con pocas complicaciones, y su implantación quirúrgica debe ser considerada por los veterinarios, en particular para el tratamiento a largo plazo.

**Palabras clave:** *acceso intravenoso, oncología médica, procedimientos quirúrgicos vasculares, quimioterapia.*

### Resumo

**Antecedentes:** os cateteres venosos centrais (VAPs) permitem acessos repetidos ao sistema vascular com mínimo desconforto ao paciente. **Objetivo:** descrever a técnica cirúrgica, cuidados de manutenção e complicações dos VAPs de veia jugular utilizados atualmente no Serviço de Oncologia Veterinária do Hospital Veterinário de Pequenos Animais da Universidade da Florida. **Conclusão:** o VAP pode permanecer no local por longos períodos (meses) com poucas complicações. O implante cirúrgico descrito no presente trabalho deve ser considerado pelos médicos veterinários, particularmente para tratamentos de longa duração.

**Palavras chave:** *acceso intravenoso, oncología, procedimientos cirúrgicos vasculares, quimioterapia.*

## Introduction

Totally implantable subcutaneous vascular access ports (VAPs) are devices used to access the circulatory system with less discomfort for the patient compared to a standard venipuncture. The port consists of a small titanium or plastic chamber with an injection membrane of compressed silicone septum. Attached to the base of the port there is the catheter that is placed in large veins. VAPs provide repeated access to the vascular system for long-term blood sampling and blood donation, analgesia, chemotherapy, parenteral nutrition, antibiotics, fluids and drugs. It is indicated especially for small patients or fractious animals. (Bagley and Flandres, 1990; Webb *et al.*, 1995; Albarellos *et al.*, 2003; Swindle *et al.*, 2005; Cahalane *et al.*, 2007). The major benefit of a VAP implant is reduced pain and stress associated with repeated venipuncture. This is especially true in cancer patients due to repeated blood sampling for cell counts and administration of intravenous chemotherapy, plus anesthetic drugs for radiotherapy for patients undergoing up to 18-20 doses of radiation (Niederhuber *et al.*, 1982; Newman *et al.*, 1989; Schwarz *et al.*, 1997; Ignatov *et al.*, 2008).

In dogs and cats, VAPs with open-ended catheters are usually placed into the jugular vein in animals. The rate of complications for jugular use is less than 5%, with most being minor, and not necessitating VAP removal (Hai, 1982; Henry *et al.*, 2002; Morrison *et al.*, 2007).

The purpose of this article is to describe the surgical technique for jugular VAP placement,

removal, maintenance and complications in dogs and cats, routinely used at the Veterinary Oncology Service of the University of Florida Small Animal Hospital.

## VAP device

The Veterinary Oncology Service at the University of Florida Small Animal Hospital uses a VAP device (Vascular Access Port, Norfolk Vet products, 7350 N. Ridgeway, Skokie, IL 60076) that consists of a titanium injection chamber with a compressed silicone septum and an attachable radiopaque silicon rubber catheter with depth markings, boot connector and rounded tip (Figure 1A). The catheter used for cats and small dogs (<15 kg bodyweight) is a 5 French/16 G, and for larger dogs (>15 kg bodyweight) a 7 French/13 G silicone catheter is preferred.

## VAP implantation technique

Animals should be fasted for 6 to 12 hours and prepared for a minor surgical procedure. VAPs are placed under general anesthesia, using a modified technique described by Seldinger (1953). The left ventrolateral area of the neck is clipped and aseptically prepared. Patients are positioned into right lateral recumbency with a sandbag or towel beneath the neck to elevate the jugular and create a slightly convex surgical field (Figure 1B). The VAP is inspected for defects and tested for pressure with heparinized saline (500 IU/mL of 0.9 saline solution). The distance from the mid neck jugular puncture to approximately the

second rib is recorded and marked to predetermine the catheter length. At this location the catheter will lie in the cranial vena cava, just cranial to the heart.

The left external jugular vein is found in mid neck and a 2 cm skin incision is made parallel and lateral to the vein in the mid-cervical region. A second incision 3 cm long is made in a dorso-ventral direction at the level of the cranial end of the jugular incision, in the dorsal third of the neck (Figure 1C). A subcutaneous pocket caudal to this second incision is created using blunt dissection to accommodate the VAP injection chamber.

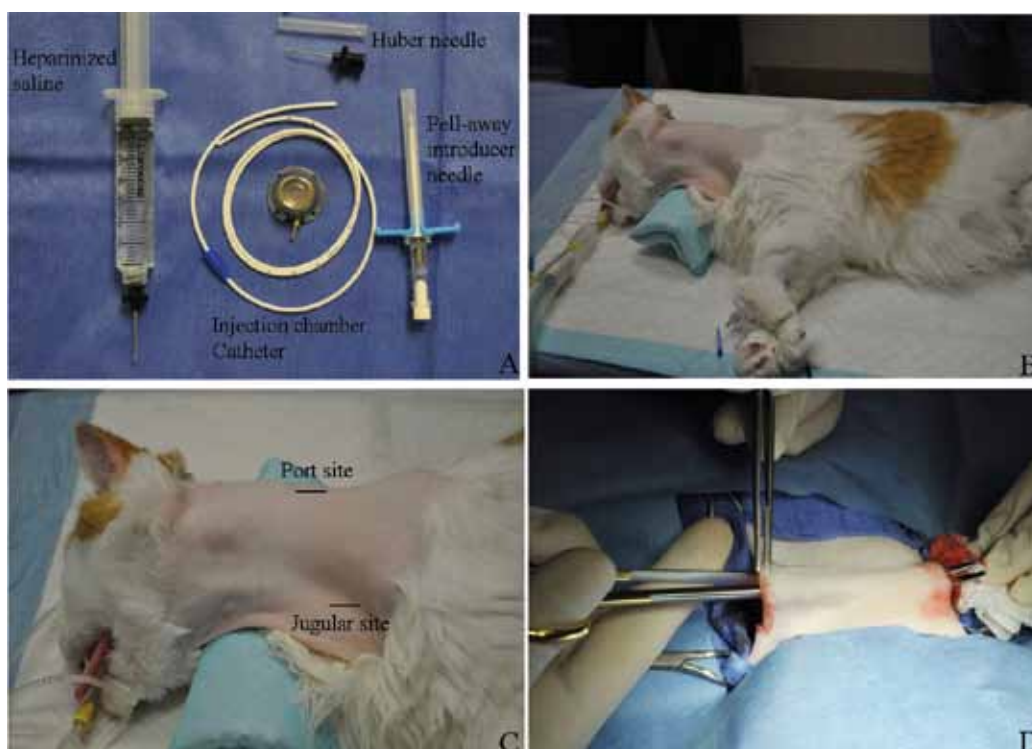
A subcutaneous tunnel is created from the port incision to the jugular incision site using blunt dissection (Figure 1D) and the unmarked end of the catheter is passed through the tunnel.

At this point the excess catheter is cut and it is connected to the port (Figure 2A). The VAP is flushed with a non-coring needle (Huber needle) with

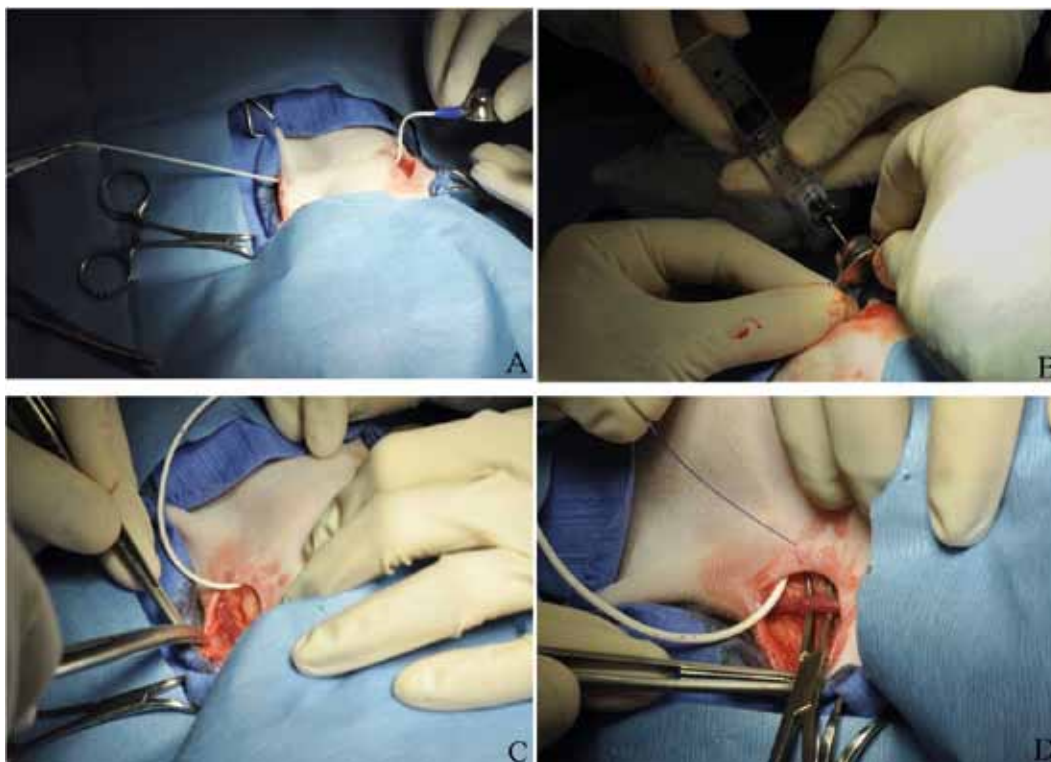
1 ml heparinized saline (500 IU/mL of 0.9% saline solution; Figure 2B). The left external jugular vein is gently dissected and it is isolated by placing a stay suture beneath the vein at both the cranial and caudal ends of the dissection with 3-0 polydioxanone suture (Figure 2C and 2D).

The jugular vein is gently elevated by the stay sutures and the inner introducer needle is used to puncture the vein in a caudal direction (Figure 3A, 3B, and 3C). The needle is removed, leaving the peel-away sheath in place and the catheter is introduced and advanced into the vessel up the previously recorded mark (Figure 3D).

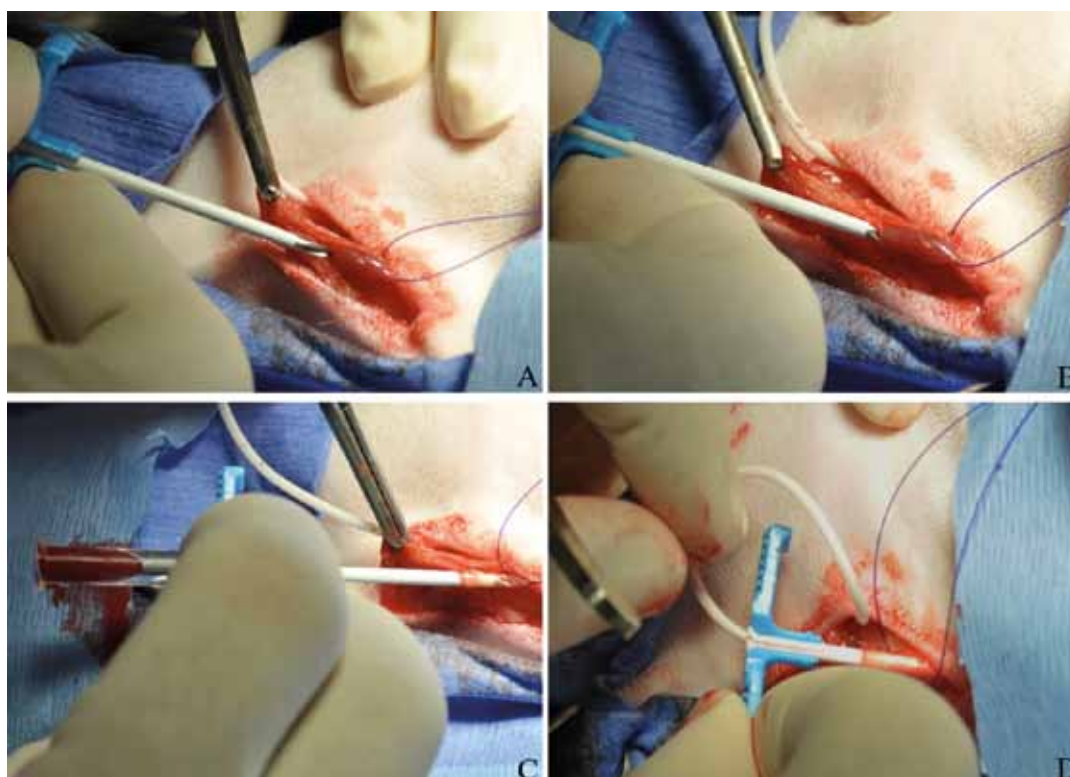
The two handles of the peel-away sheath are grasped and pulled out until the sheath is removed leaving the catheter into the vessel (Figure 4A). The distal stay suture is used to gently ligate the vein and catheter, distal to the venotomy puncture site (Figure 4B). The cranial stay suture is tightened to occlude the jugular vein proximal to the venotomy



**Figure 1.** (A) Components of the vascular access port (VAP) and a non-coring needle (Huber needle) attached to a syringe with heparinized saline (500 IU/mL of 0.9% saline solution). (B) Patient positioned into right lateral recumbency with a towel beneath the neck to elevate the jugular and forelimbs in neutral position. (C) The jugular and the port site schematic skin incisions. (D) The subcutaneous tunnel that is created from the port incision to the jugular incision site using blunt dissection.

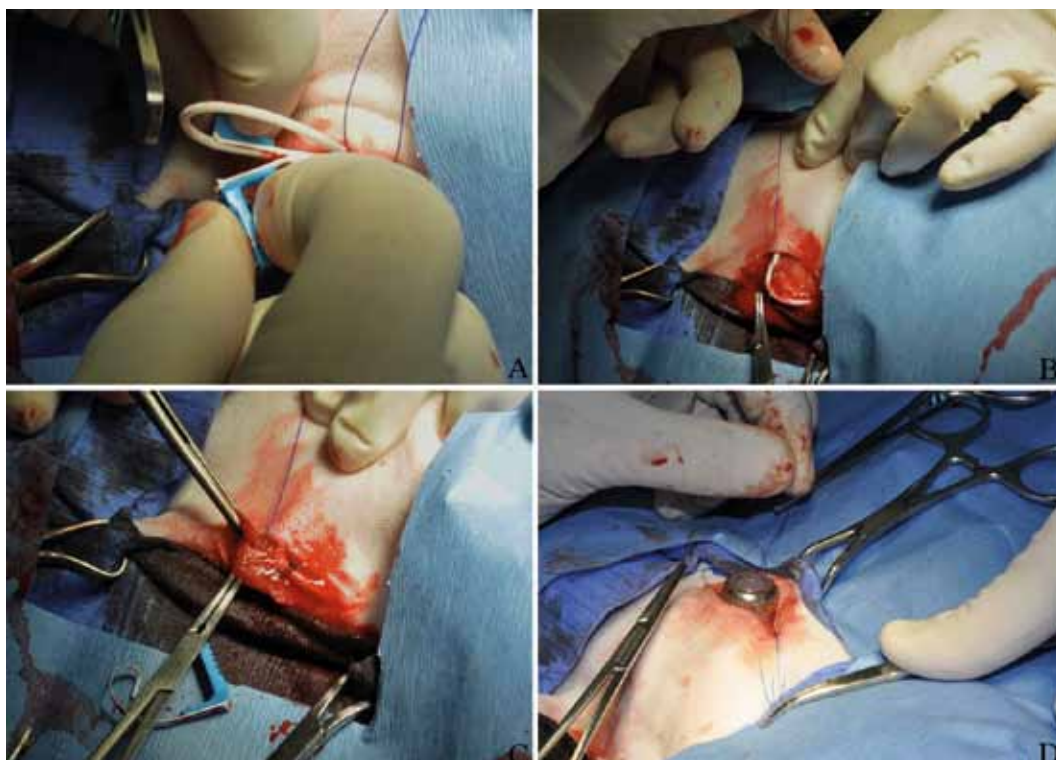


**Figure 2.** (A) A catheter passed through the subcutaneous tunnel and the connected ports are shown. (B) Testing the catheter patency with heparinized saline. (C) Dissected jugular vein from the subcutaneous tissue. (D) Placement of a stay suture beneath the vein.

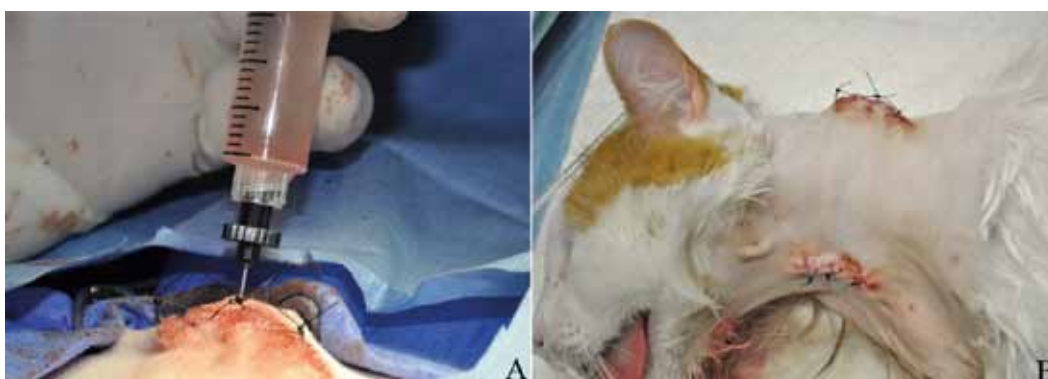


**Figure 3.** (A) Jugular elevation and (B) needle puncture. (C) Needle progression into the vein. (D) introduction of the catheter.





**Figure 4.** (A) The peel-away sheath is pulled out and the catheter is left into the vessel. (B) Ligation of the distal stay suture. (C) Ligation of the cranial stay suture. (D) Pre-placed sutures positioned in the chamber and deep muscular layer.



**Figure 5.** (A) Confirmation of VAP patency. (B) Final appearance of VAP placement.

site in order to reduce hemorrhage (Figure 4C). Sutures of 2-0 polypropylene are pre-placed through the anchor points into the underlying fascia. Deep fascial bites are taken and tension is applied to ensure they do not tear through prior to performing the knot (Figure 4D). The chamber is positioned inside the subcutaneous pocket, away from the skin incision with the catheter exiting cranio-ventrally, and sutures are locked in order to avoid the chamber from becoming dislodged and flipping over.

VAP patency is confirmed by blood aspiration with a non-coring needle (Huber needle) prior to flushing the system with 3 ml heparinized saline (500 IU/mL of 0.9% saline solution; Figure 5A). The two incised sites are closed in a routine pattern with an appositional continuous 3-0 polyglecaprone suture in the subcutaneous tissue and simple interrupted 3-0 nylon for skin (Figure 5B).

### VAP maintenance

Patients are evaluated one day after surgery, and after that rechecks are determined by the treatment protocol for each patient. In cases where the VAP is not being used it is recommended to flush it with heparinized saline once a month. At each VAP use, the skin above the port is aseptically prepared, the chamber is held in place and a Huber needle (22G x 3/4 inch needle with a bent tip) is inserted through the skin into the chamber. Blood aspiration is performed and the system is flushed with 1-2 mL of 0.9% saline solution containing 500 IU heparin/mL in order to clear the VAP and catheter. The VAP is then flushed after the blood draw with 3 mL heparinized saline solution and the needle is removed. Repeated vascular access through the VAP can be obtained without sedation or anesthesia and with minimal physical restraint.

### VAP removal

VAPs are normally removed when long term treatment is over or if there are complications. Patients are anesthetized and the skin is clipped and prepared as for VAP placement. A 2 cm skin incision is made directly over the chamber and subcutaneous and fibrotic tissues are incised. The sutures anchoring the port to the fascia are located and cut and all suture remnants are removed. External pressure is applied to the jugular vein and port and catheter are withdrawn with traction. Mild pressure is applied over the jugular vein for five minutes to avoid blood extravasation. The incision is closed using a two layer suture.

### VAP complications

In human patients, the two most significant VAP-related complications are thrombosis and infection. Catheter-related thrombosis may be linked to pre-existing hypercoagulability, venous irritation due to chemotherapeutic agents, and venous stasis caused by tumor compression (Denny, 1993; Sehirali *et al.*, 2005). In dogs and cats, VAP-related thrombosis has only been reported in a small number of patients, even with the placement of small diameter catheters (Culp *et al.*, 2010). Infection is considered a major catheter complication. When it occurs between 3 to 5 days post operatively, it is assumed to be due to contamination

introduced at the time of surgery (Coward *et al.*, 1999; Henderson *et al.*, 2003). The use of prophylactic antibiotics for VAP placements is controversial, though a single dose of a broad-spectrum antibiotic prior to the incision is prudent as a potentially permanent implant is being introduced. Delayed infection can occur at the catheter exit, in the pocket, or via hematogenous seeding from a distant site (Denny, 1993). In veterinary medicine, the systemic infection rate is reportedly lower than 10% and the infection is resolved after VAP removal and antibiotic therapy based on a sensitivity test (Valentini *et al.*, 2013).

Local seroma formation is a common complication in veterinary patients, particularly when the jugular vein is used, since VAP placement at this location requires more subcutaneous dissection (Aubert *et al.*, 2011). To avoid seroma formation it is recommended to eliminate dead space by using subcutaneous sutures and to place the port within the pocket, not directly beneath the skin incision (Mayer *et al.*, 2008).

Mechanical complications are usually related to poor port anchoring and suture breakage which may result in VAP mal positioning and difficulty accessing the port. Anchoring the port in a stable position might be challenging (Cahalane *et al.*, 2007). Pre-placing sutures to the anchor points into the underlying muscle are recommended to avoid port malposition (Farrow *et al.*, 2013). Furthermore, getting familiar with the surgical technique reduces positioning and catheter length problems.

The optimal length of the catheter can be determined by anatomic landmarks or with intraoperative fluoroscopy to assess the position of the catheter tip. The use of fluoroscopy is more accurate to assess catheter tip placement before cutting the desired length, and the tip location should be reassessed by fluoroscopy after anchoring the port to the fascia layers (Mayer *et al.*, 2008). When fluoroscopy is not available, the final position of the catheter can be assessed with radiographs that should be taken immediately after surgery. Recommended location for the catheter tip for a VAP in a jugular vein is the cranial vena cava (Bagley and Flanders, 1990). Placement of the tip within the heart is not recommended because of the risk of endocardial irritation and arrhythmia (Evans *et al.*, 1994).

## Conclusion

The VAPs allows continuous vascular access in patients that need repeated intravenous blood draws or injections, and are well tolerated by dogs and cats. VAPs are implanted to aid treatment in veterinary cancer patients with chronic illness and immune-compromise. The VAP system should be considered by the veterinary oncologist to improve the welfare of animals receiving multiple injections as part of long-term treatments.

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## Conflicts of interest

The authors declare they have no conflicts of interest with regard to the work presented in this report.

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