Patient care pathway in an innovative Central Venous Access (CVA) Unit

Interview with Dr Frederic Gomas, head of the Venous Central Access unit, Institute Gustave Roussy, France.

The Institute Gustave Roussy (Villejuif, France), a leading European cancer center, brings together 3,000 professionals mobilized to treat patients suffering from cancer. With a cultural mindset of ‘cross-boundary working’ and ‘multi-disciplinary patient management’, the Institute is conducting research to develop new therapies and passing on knowledge to the worldwide medical and scientific communities.

Within the Surgical and Interventional Pole, the unit of Venous Central Access (VCA) is a major contributor of the patient cancer care pathway. The unit has recently expanded its activity with a new operating room to meet the increasing demand for Central Venous Catheter (CVC) procedures. The Institute has selected OEC One CFD, an all-in-one C-arm with advanced imaging features.

Dr. Frederic Gomas explains the choice of the Institute and how the OEC One CFD C-arm answers the needs of the VCA unit activity.

Can you explain the activity of the CVA unit?

The Institute has been involved in the development of the percutaneous technique for the implantation of central venous access lines. My predecessor and anesthesiologist Dr. Desruennes participated in building and introducing this technique in France. He also contributed to the creation of the CVA unit within the anesthesia ward. This organizational model ensures the centralization of information and knowledge to support the coordination of all the healthcare professionals in the patient cancer care pathway.

In the percutaneous approach, instead of just using anatomical landmarks, we identify the vein and perform the puncture under ultrasound control. We need fluoroscopic imaging to control the positioning of the extremity of the tunneled catheters, Peripherally Inserted Central Catheter (PICC) and Totally Implanted Venous Access Devices (TIVAD)[1].

The mission of the CVA unit is to coordinate the activities of the 14 implant anesthesiologists of CVC procedures. These specialized anesthesiologists manage preventive care activities to avoid potential complications as well as the follow up after implantation of the line. Working through the dedicated unit helps the coordination of the multifunctional team, giving them access to a point of reference for the patient before and after the line implantation.

How does OEC One CFD assist performance of the CVA unit?

Even though fluoroscopic imaging control is very short, it is mandatory for the implanter to ensure that the line is properly placed before discharging the patient.

In order to address the increasing volume of procedures, we put in place a process at each step of the patient pathway in our unit and inside the operating room. The staff supporting the organization of the CVA unit is composed of a nurse in the reception area, a care assistant, a bearer coordinating the arrival of hospitalized patients, a nurse inside the operating room, and an administrative assistant who receives the ambulatory patients. The architecture of the unit has been thoroughly vetted to optimize the patient workflow from the reception of the patient, during the procedure itself, and up to the discharge of the patient.

Inside the operating room during the procedure we are only assisted by one nurse. The room is quite small (about 29 m²) and busy, so it was mandatory to equip it with an all-in-one C-arm that would not congest the room.

We have set up the OEC One CFD C-arm with the parameters the team selected: automatic patient file filling (downloading the data from the worklist), dose management during the procedure (working only in low dose and 8 pulses per second - pps) and archiving the patient images and dose report (sending them to the PACS and to our dose management software). The users of the C-arm are the anesthesiologists and the nurses of the CVA unit. As the user interface is intuitive and very easy to understand, the OEC One CFD C-arm facilitates the fluidity of our patient workflow.

The average time for a CVC procedure is about 20 to 30 minutes. The implantation itself takes about 10 minutes. The imaging procedure requires less than 10 seconds of X-ray activation time.

With our process and the OEC One CFD C-arm, we have been able to reach a maximum workflow of 16 CVC procedures a day in the new operating room.

For the implantation of a TIVAD, there is an additional step connecting the catheter to the port (small chamber of injection). The port is placed underneath the skin. The final position of the tip of the catheter at the junction of the SVC with the RA is controlled with a fluoroscopic image after connecting the port.

> *"The depth of the C-arm is the right compromise for the CVC procedures: small footprint and large enough to reach the anatomy.*
>
> **Doctor Gomas**

Can you describe a typical CVC procedure?

The patient is placed in supine position. The procedure starts by the puncture of the jugular vein under ultrasound guidance. Then the graduated catheter is pushed to an estimated length (about 14 to 16 cm from the puncture). The fine tuning of the placement of the tip of the catheter at the junction of the Superior Vena Cava (SVC) with the Right Atrium (RA) is performed under fluoroscopy. In order to reduce radiation exposure to the patient and to the staff, we limit the fluoroscopic imaging to the control of the tip of the catheter in this junction. The last fluoroscopic image done is archived as proof of the success of the procedure outcome.

How does OEC One CFD support your activity?

As I mentioned earlier, the OEC One CFD C-arm supports our workflow with its small size, its low dose imaging capacity and its ease of use that includes quite a lot of automation.

All-in-One

In our organization, the C-arm is dedicated to the CVA operating room and it is always placed at the head of the patient, along the patient axis. The room set-up is always the same even for a femoral access because we just need to check the junction point. We don't use fluoroscopy to guide the catheter to this junction. The depth of the C-arm is the right option for the CVC procedures: small footprint and large enough to reach the anatomy.

1 Desruennes E, Gomas F [Central venous access for cancer chemotherapy]. Presse Med. 2018 Apr;47(4 Pt 1):320-330.

"The image quality of the OEC One CFD C-arm in low dose mode and 8 pps is crisp enough to identify the anatomical landmark and the extremity of the catheter, even while the catheter tip moves quite a lot once it enters at the junction of the SVS and the right atrium."

Doctor Gomas

High Image Quality allowing dose reduction

The big advantage of the OEC One CFD C-arm over our former C-arm is the CMOS detector that permits the optimization of radiation exposure, while maintaining the necessary image quality needed for the procedure. We are able to reduce the dose to the minimum and see the catheter tip moving in the vicinity of the carina. As our patients are exposed throughout their medical treatments (with CT scanners, Interventional radiology and radiotherapy exams) we consider that whenever we can reduce radiation exposure, it is better for the patient and has to be done.

For the CVC procedures or central lines implantation procedures (tunneled catheters, PICCs or TIVADs) we work with a fluoroscopy mode set to low dose and 8 pulses per second. It is the mode we choose that allows us to have the required image quality to carry out the procedure. Indeed, during the procedure we want to see: the extremity of the catheter, the vertebral bodies, and the tracheal carina. The radiological landmark of the anatomy for the junction of the SVC and the RA is the zone located about 1.5 to 2 vertebral bodies below the carina. In very few cases of patients with a thoracic pathology, the carina might be difficult to see under X-ray, so we use the ElectroCardioGram (ECG) to help localize this position. We never change the dose set-up. The image quality of the OEC One CFD C-arm in low dose mode and 8 pps is crisp enough to identify the anatomical landmark and the extremity of the catheter, even while the catheter tip moves quite a lot once it enters at the junction of the SVS and the right atrium.

Ease of Use

In order to comfortably do 16 procedures per day, the C-arm must not be complicated to use. The implantation time is critical. We are trained to perform the implantation in 10 to 12 minutes (between incision and dressing).

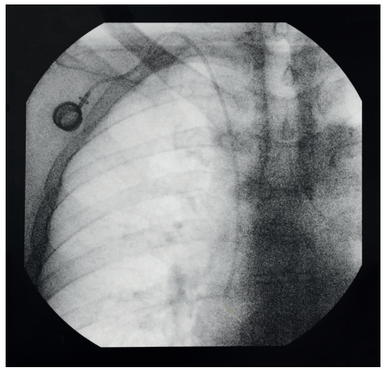
The technique of line implantation is called the Seldinger modified technique. Once the incision area is sterilized, the anesthesiologist proceeds to the anesthesia of the deep tissues. He localizes the vein under ultrasound and proceeds to puncture it with a needle mounted over a syringe. He introduces a guidewire through the needle and removes it after confirming that the guidewire is inside the vein. He slides the introducer over the guidewire, then he slides the catheter through the introducer, and lastly he pushes it to its final position. The implant anesthesiologist performs a fluoroscopic control image of the tip of the catheter at the junction of the SVC with the RA. Once confirmed he ends the procedure with the dressing of the wound.

For the fluoroscopic control, the anesthesiologist pulls the OEC One CFD C-arm over the patient's chest and takes several X-rays. Images are automatically saved on the hard drive. The adjustments of the fluoroscopy techniques are automatic as well as adjustment of brightness and contrast of the image. No additional manual adjustments are necessary.

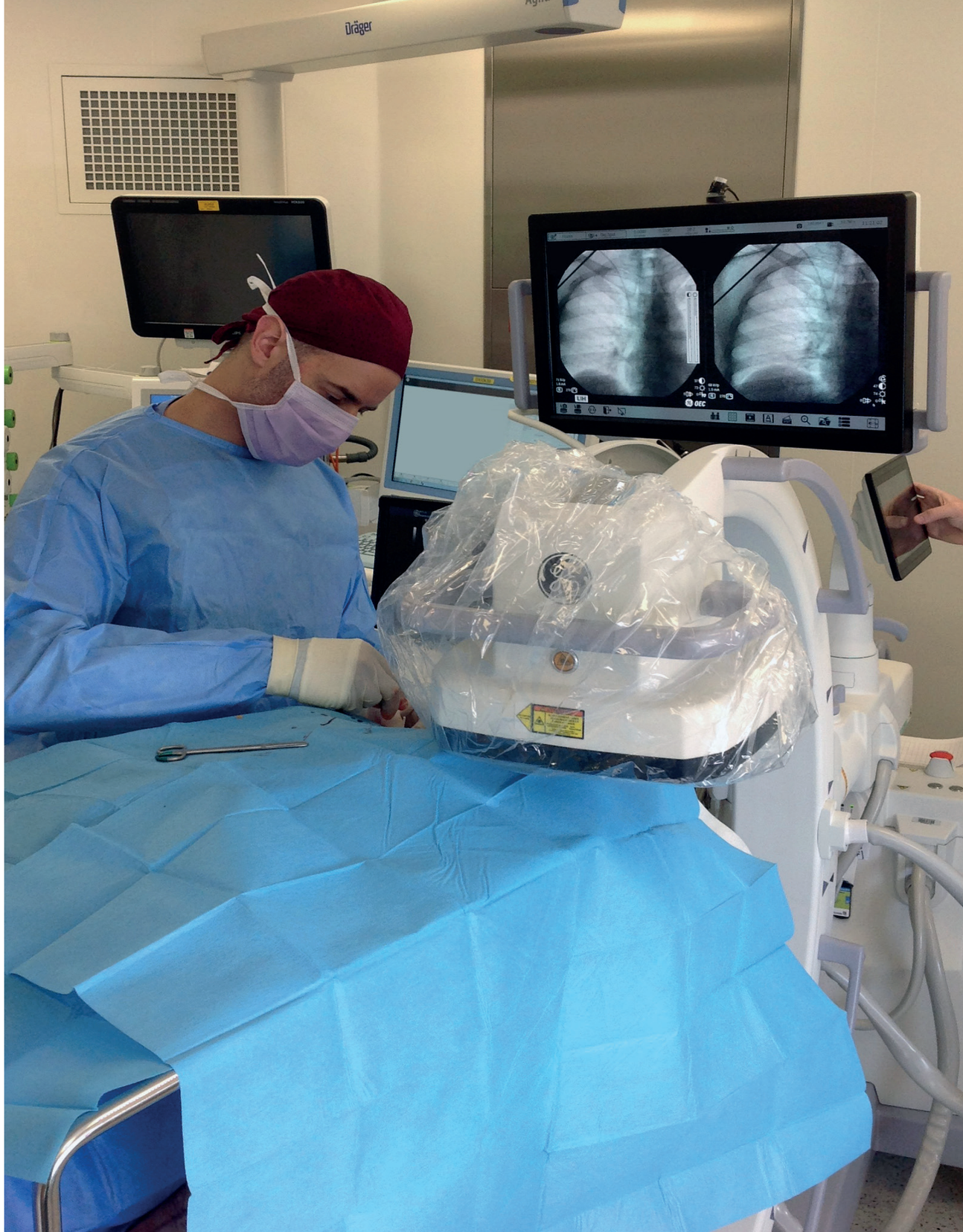
The nurse and the anesthesiologist clean the C-arm after each patient. As the C-arm is connected to the PACS, they send the patient data to the archives and retrieve the information file for the next patient.

In 2019, our unit performed the implantation of 2,939 CVC; 2,023 TIVAD; 781 tunneled catheters; 82 PICC and 53 cytapherese catheters. Among these procedures, about 300 to 400 are pediatric cases managed by 9 specialized anesthesiologists.

In our modern unit, considering the small operating room and the important volume of procedures, the OEC One CFD C-arm has brought us the comfort and the performance to maintain our optimized workflow.



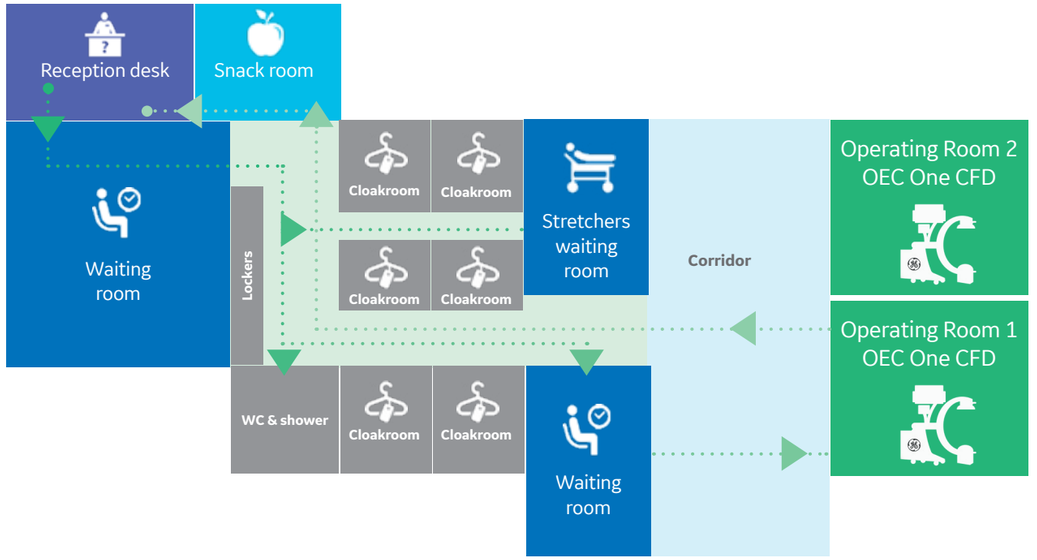
Final fluoroscopic control of TIVAD implant with OEC One CFD.



“Ambulatory express”

Since the creation of the CVA unit within the anesthesiology ward we have striven to develop all the logistics and organization around the procedure: from the architecture, staff, and equipment perspectives.

From inception, the patient pathway, called “ambulatory express”, starts with the patient arriving directly in the center of the operating ward. Admissions, examinations and interviews are done by the reception nurse, who answers any potential questions the patient might have. The care assistant helps the patient change into a sterile smock needed in the operating room. When the patient is ready, the care assistant takes him to the waiting room located just in front of the operating room. Once the patient enters the operating room, the nurse and the doctor position him over the examination table. They then start the checklist and proceed to prepare for the puncture. Preparation takes as much time as the procedure itself (about 10 min). Once the procedure is finished, the care assistant takes the patient to the snack room, where he stays for about 10 to 15 minutes. Then the dressing is checked, instructions and prescriptions for discharge are given, and finally the patient can go home.



ADMISSION ----------> 20 minutes

- **Patient arrives at reception desk directly at the OR floor level**
- **The reception nurse performs admission interview**

- **Patient takes a shower if not done at home**
- **Patient changes in cloakroom and leaves personal belongings in lockers**

PROCEDURE ----------> 10-20 minutes

- **Patient waits to be lead to the Operating room**
- **Patient enters in the OR walking while the OR is preparing for the procedure**

DISCHARGE ----------> 20 minutes

- **Once surgery ends, patient leaves the OR walking back to the cloakroom**

- **Patient gets dressed and takes a snack**
- **The reception nurse gives the prescriptions and confirms the appointments for the first chemotherapy therapy treatment**

I am an intensive care anesthesiologist with experience in pediatric care. I specialized in CVC implantation at the Institute Gustave Roussy during my internship. I became the head of the CVC unit 5 years ago.

The high volume of procedures at Gustave Roussy Institute provides us quite a lot of experience. We expand our experience and share our practices through training other practitioners from less experienced centers from France and other countries (mainly North Africa and Eastern Europe). The training includes a theoretical part to reinforce technical aspects of the procedures as well as the observation of several cases in the operating room. We also share our experience of clinical indications, the management of potential complications and also the organization of the unit. The training content is customized depending on the objectives of the practitioners: to start or to improve the activity.

I like the surgical gesture of catheter implantation. For some patients, the placement can be more complicated and more technical. The true reason I love this job is that usually as an anesthesiologist we have very few links with the other healthcare providers of the hospital. Working as an implanter anesthesiologist in the CVC unit, I have many interactions with doctors and nurses from the oncology, chemotherapy, radiotherapy, and surgery wards. Through this collaboration I get a more comprehensive overview of the management of patient care, understanding what the good indications are, and when to derogate from these indications depending on the potential complications. I can better measure the impact of my intervention, which takes only 10 minutes. It seems trivial if we consider the full treatment for cancer the patient will go through. However, the catheter must stay in place for several months and the patient will have to deal with it. I have to balance the choice of the technique with the needs of the patient comfort, and the needs of the users of the venous access line. It is a multi-lateral decision for the best solution.

In the evaluation of the solution we consider the psychological factor. From the patient perspective, the implantation of a CVC means the onset of the disease. From the moment he enters the operating room, the patient understands that they have cancer and that he will go through chemotherapy. As patients are totally awake and aware, they often ask lots of questions. We make sure we always answer so they feel as comfortable as possible during the procedure. Before starting the incision, I ask the patient for their favorite music, which the nurse always finds in our huge playlist – and we play it during the procedure.

The statements by GE's customers described here are based on their own opinions and on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist, i.e. hospital size, case mix, etc.. there can be no guarantee that other customers will achieve the same results.