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Case Report

Experience with a triple-lumen catheter for autologous stem-cell transplantation

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ABSTRACT

We relate our experience with the Cook (Cook Medial Inc., Bloomington, IN, USA), triple-lumen hyperalimentation (HAS) catheter for treatment related to autologous stem-cell transplant. Nineteen HAS catheters were implanted in the right jugular vein, and tunneled to the right anterior chest wall, under imaging guidance. Retrospectively, we reviewed each catheter. Three patient's experienced "ballooning" of the middle (white) lumen of the HAS catheter during routine use. We assessed, time in situ, follow-up imaging, chemotherapy regimen, possibility of systemic or device infection, tissue pathology of the patient's malignancy, and other factors to attempt to determine if there were any associations that could explain the catheter lumen failure. After this pilot study of the HAS-catheter in these 19 patients, we discontinued use of this device at our facility due to mechanical problems of ballooned and obstructed middle lumens. There was no obvious cause, or association, detected to explain the ballooning identified.

Introduction

Multilumen venous access devices are extremely helpful for the management of patients undergoing stem-cell transplantation and have been shown to have manageable, if any, side effects. [1] The multiple lumens allow for the dedicated administration of medications, chemotherapy, fluids, blood products, and alimentation when clinically required. Our local stem-cell transplant teams had been using a dual-lumen catheter and were in need of a triple-lumen catheter that would enhance patient management and facilitate medical and nursing care. The Cook hyperalimentation (HAS) catheter was selected by the local Cancer Agency Stem-Cell Transplant team to be trialed as a triple-lumen catheter. We report our experience with this device in 19 patients.

This was a retrospective review of the patient's imaging and medical history for the purposes of a Quality Assurance project. As such, our local Research Ethics Committee waived the requirement for a full ethical review and approved this project.

Materials and methods

The HAS catheter is described in manufacturer's product literature to, "provide for the intravenous administration of nutrient fluids, chemotherapeutic agents, therapeutic drugs,

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and for blood sampling, blood delivery, and venous pressure monitoring" (Cook Medical Inc., Bloomington, IN, USA). The device used was a triple-lumen, 12.5F with the large lumen of the catheter able to accommodate a 0.038-in guidewire. The lumen configuration of the HAS catheter reveals 2 large, half-lunar shaped lumens with a very small third lumen interposed between the 2 large lumens (see Fig. 1).

Sequential patients enrolled in the autologous stem-cell transplant program received the HAS catheter.

All of the HAS catheters assessed in this study were implanted by interventional radiology using ultrasound and fluoroscopic guidance for proper catheter positioning with the final catheter tip at the superior vena cava–right atrial junction (see Fig. 2).

Right internal jugular venous access was achieved, with ultrasound and fluoroscopic guidance (see Fig. 3). The HAS catheter was tunneled from an anterior chest wall location to the internal jugular vein access site. The catheter was supplied with a standard 25-cm length, which was cut to a length that suited the patient's anatomy. Using a 13F peel-away sheath (Cook Medial Inc., Bloomington, IN, USA), the catheter was manipulated to the superior vena cava–right atrial junction using fluoroscopy. The catheters were fixated to the patient by applying 2, nonabsorbable, Prolene skin sutures using the built-in catheter suturing wings (Ethicon US LLC, Somerville, NJ, USA). The 3 lumens of the catheter were flushed and closed with a solution of sterile, heparinized saline (100 IU heparin sulfate/mL, Pharmaceutical Partners of Canada, Richmond Hill, ON, Canada). All implanted catheters were functioning satisfactorily at the completion of implantation.

Results

All catheter implantations were successful at the primary visit, resulting in a 100% technical success rate. The right internal jugular vein and the right anterior chest were used for all patients. No implantation complications were encountered. There was no unusual angulation of any of the catheters at the jugular vein insertion site or in the chest wall.

Fig. 1 – An image of the distal end of the HAS catheter demonstrates the configuration of the 3 lumens with the small, middle lumen interposed between the 2 large half-moon shaped lumens.

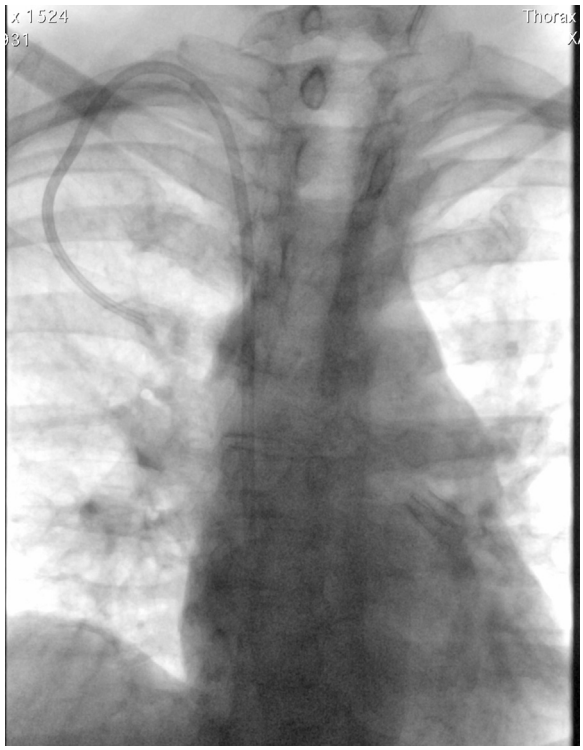

Fig. 2 – Fluoroscopy imaging after catheter insertion.

Nineteen patients received the HAS catheter for treatment. There were 9 females and 10 males. Their age ranged between 30 and 71 years (mean = 53).

Ten of the patients were being treated for Multiple Myeloma, whereas the other 9 had some form of lymphoma.

Three patients experienced "ballooning" (see Fig. 4) of the middle (white) lumen of their HAS catheter. The "ballooning" was not a permanent deformity, and was most pronounced during attempts to use the middle (white) lumen. Once the "ballooned" catheters were removed a mild contour bulge was obvious on general inspection. The initial detection of these ballooning events occurred at 15, 19, and 20 days post-HAS-catheter insertion. The ballooned lumens were all occluded, and the deformity of the catheter occurred with forceful flushing by the clinical team. These catheters were not removed after ballooning because the remaining 2 lumens (blue and red) were still functional.

We performed a retrospective review of all 19 patient's charts to look for any possible explanation for this complication. Ballooning of the white lumen occurred during routine flushing by 3 different nurses assigned to each patient's care in all 3 cases. A different interventional radiologist implanted each of these ballooned catheters.

All 3-ballooned catheters were implanted in male patients. Seven of the 19 patients had a positive blood culture during the course of their catheter insertion, while receiving stem-cell transplant inpatient treatment. Two of these 7 patients also experienced ballooning of the white lumen.

Patients had anywhere from 0 to 9 chest x-rays, while the catheter was implanted, with patients having an average of 3 (standard deviation = 2.0). One of the chest x-rays revealed