



Snapped without warning—a case report of a retained spinal drain catheter

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To the Editor,

A lumbar spinal drain (Natus® Lumbar Drainage Catheter Kit II, NT821707; Natus Medical Incorporated, San Diego, CA, USA) was placed in a 68-yr-old patient prior to his thoracic endovascular aortic repair. The drain fractured unexpectedly during removal, and we identified a feature of the catheter as a possible risk factor for breakage.

The patient had a prior gunshot injury that left a bullet in the third lumbar (L3) vertebra. There was no bullet or bone fragment below the L4 vertebra based on computed tomography (CT). The spinal drain placement was unremarkable at the L4–5 level with one needle pass, and the catheter was advanced 10 cm into the intrathecal space. The drain was maintained until postoperative day three when the surgeon requested removal. The patient was placed in a fetal position for the removal. A little resistance was met but no significant stretch of the catheter was noticed. After removal, it was found that the catheter broke at the most proximal fenestration. Computed tomography revealed a retained catheter extending from the L4–5 interspinous region into the thecal sac (Figure, panel A). The patient remained asymptomatic and declined surgical removal of the retained catheter.

Catheter damage during placement has often been identified as a cause of breakage.^{1,2} Although it is

impossible to rule it out, we found no reason to suspect catheter damage during this straightforward placement. The retained segment should have been 5.8 cm long based on measurement of the same segment of a brand-new catheter; however, it measured approximately 6.8 cm on the CT. This suggests that the retained segment, mainly consisting of fenestrations, was stretched during removal.

We compared Natus catheters with Hermetic™ spinal drain catheters (Integra LifeSciences, Princeton, NJ, USA) that were routinely used by our regional anesthesia team until backordered. The Natus catheter features 18 pairs of fenestrations, and each pair consists of one larger and one smaller fenestration (Figure, panel B). There are only six pairs of equally sized fenestrations on the Integra® catheter, and the adjacent fenestration pairs are positioned with a 90° offset to increase the linear distance between the fenestrations (Figure, panel B).

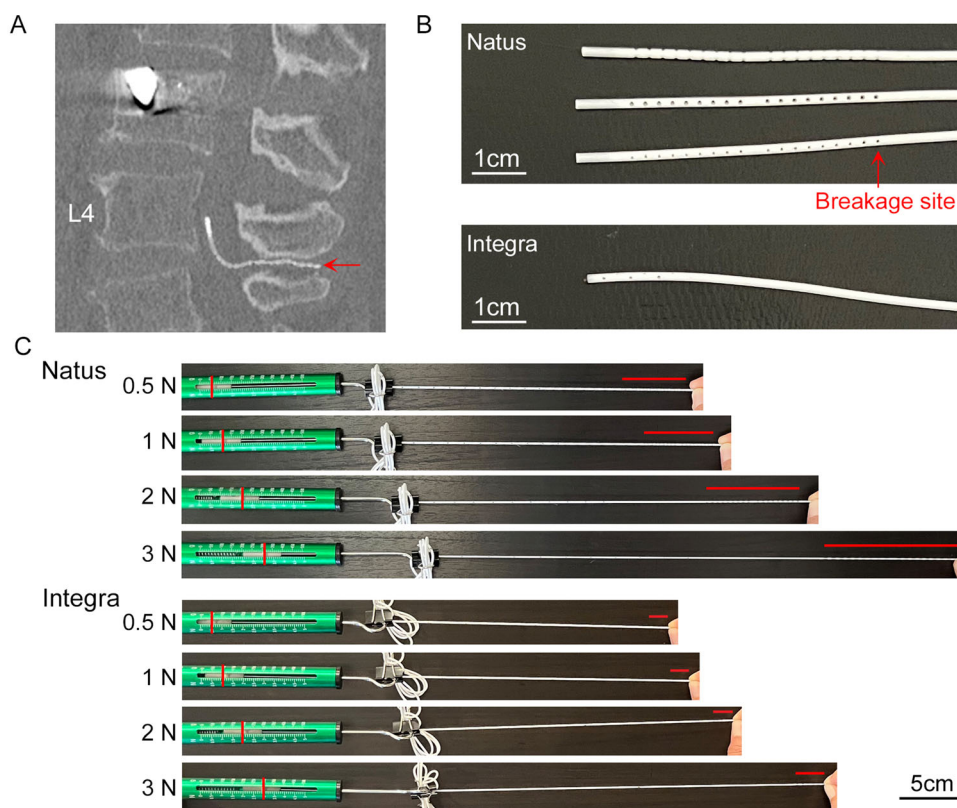
We tested the two catheters under stretching forces. A catheter was attached to a spring scale (0–10-N range, 0.2-N increments) and then slowly pulled by way of the tip until it broke. It was noticed that the fenestrations on Natus catheters started to elongate with a pulling force of 1 N and became distorted at 2 N, while the rest of the catheter barely changed. With a pulling force of 3 N, the entire catheter stretched and the fenestrations severely thinned and elongated (Figure, panel C). The fenestrations on the Hermetic catheters did not stretch noticeably until the pulling force reached 2.5–3 N, when the entire catheter started to elongate (Figure, panel C). Three Natus catheters broke at 4.6 N, 6.2 N, and 5.0 N, and two Hermetic catheters broke at 5.0 N and 5.2 N, respectively.

The pulling forces required to break the two catheters is less relevant in practice because spring scales are not used during catheter removal. Clinicians usually rely on tactile

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Figure (A) A sagittal view of the lumbar spine showing the retained spinal drain catheter (red arrow) and a retained bullet in the L3 vertebra. The image of the catheter fragment was reconstructed from multiple CT images to show its projection on the sagittal plane.

(B) Comparison of the fenestrations on Natus and Hermetic catheters. The breakage site was marked by the red arrow. (C) Demonstration of a Natus and an Hermetic catheter under pulling forces of 0.5, 1, 2, and 3 N. Vertical red lines on the spring scale mark the force indicator locations. Horizontal red lines mark the length of the fenestrated segment.



feedback and visual changes of the catheters to judge if a catheter is entrapped. Such techniques become unreliable, even misleading, when the fenestrations become stretched under a pulling force that does not affect the rest of the catheter, as observed with the Natus catheters.

Distorted fenestrations may incur increased friction during removal. In addition, the prevalence of calcification of ligamentum flavum and interspinous ligament increases significantly with age, affecting 14.6% and 7.3% of patients in this age group.³ Friction and possible microabrasion from calcifications could have further weakened the fenestrations during the removal.

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