LETTER TO THE EDITOR

Endovascular Tissue Sampling Using the ClotTriever Thrombectomy System: Histopathologic Analysis in 26 Consecutive Patients

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Received: 10 March 2022 / Accepted: 17 March 2022 / Published online: 1 April 2022
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Editor,

Intravascular tissue sampling may be percutaneous, endovascular, or surgical [1]. Small-volume transvenous biopsies have been described using 5.5- and 7-French biopsy forceps [1]. Small volume sampling, however, may result in lower diagnostic yields and be limited by crush artifact. The ClotTriever thrombectomy system (Inari Medical; Irvine, CA) has been used for the extraction of large-volume thrombotic and embolic materials in peripheral and central veins [2]. This report describes the results of histopathologic analysis on specimens collected via ClotTriever-mediated thrombectomy. Institutional review board approval was obtained for preparation of this report.

Twenty-six consecutive patients (14 males, 12 females; mean age 54.4 ± 15.3 years) underwent ClotTriever-mediated thrombectomy for symptomatic venous thrombosis with endovascular tissue samples sent for pathologic analyses. Twenty-three patients presented with swelling, fifteen with pain, two with fever, and one with respiratory failure. Fifteen patients underwent thrombectomy of the inferior vena cava or lower extremity deep veins, and eleven patients underwent thrombectomy of the thoracic central veins or upper extremity deep veins. Technical success, described as extraction of intravascular materials adequate for desired pathologic and/or microbiologic analysis, was obtained in all patients. There were no intra procedural adverse events. Of the removed samples, seventeen were benign (i.e., bland thrombus of various chronicity), seven were malignant, and two were infectious. Malignancies included non-small cell adenocarcinoma from lung primary (n = 2), EBV + large B-cell lymphoma (n = 1), papillary thyroid carcinoma (n = 1) [3], acute T-cell lymphoblastic leukemia (n = 1), follicular lymphoma (n = 1), and colorectal adenocarcinoma (n = 1) [4]. Infections were due to Staphylococcus aureus (n = 2). 2/7 of malignant thrombus samples demonstrated enhancement on computed tomography (CT) or magnetic resonance-based imaging studies within thirty days of the thrombectomy procedures. Clinical success, described as resolution of presenting systems, was achieved in all patients.

Benign Pathology Example

A 25-year-old man with coronavirus-19 infection presented with left lower extremity swelling and pain. CT, venous duplex ultrasound, and lower extremity venography (Fig. 1A) showed acute deep venous thrombosis extending from the left popliteal vein to the iliocaval confluence. He underwent left lower extremity thrombectomy using the thrombectomy device (Fig. 1B), followed by stent
reconstruction of the left common iliac vein with a 16 mm × 80 mm Abre (Medtronic; Dublin, Ireland) venous stent. Histopathologic analysis demonstrated bland thrombus with early organization (Fig. 1C, D), confirming benign venous occlusive disease.

Malignant Pathology Example

A 65-year-old woman with diffuse large B cell lymphoma, in remission, presented with left leg swelling. Computed tomography and lower extremity venography (Fig. 2A) demonstrated left pelvic sidewall lymphadenopathy resulting in compression of the left common iliac and external iliac veins with associated deep venous thrombosis in the pelvis and thigh. She underwent left lower extremity thrombectomy using the thrombectomy device (Fig. 2B), followed by stent reconstruction with a 14-mm × 80-mm Abre (Medtronic) venous stent and a 12-mm × 90-mm Wallstent (Boston Scientific; Marlborough, MA). Histopathologic analysis revealed sheets of EBV + B-cells consistent with relapsed large B cell lymphoma (Fig. 2C, D).

Infectious Pathology Example

A 26-year-old man with end-stage renal disease on hemodialysis via a left internal jugular vein tunneled central venous catheter presented with fever and was found to have methicillin-susceptible Staphylococcus aureus bacteremia. Prompt catheter removal and nafcillin intravenous antibiotic therapy failed to resolve the bacteremia. Computed tomography and upper extremity venography (Fig. 3A) demonstrated thrombi within the left brachiocephalic vein and superior vena cava. In an effort to provide source control for his persistent bacteremia, the patient underwent thrombectomy using the thrombectomy device (Fig. 3B). Thrombus culture yielded Staphylococcus aureus, matching prior blood cultures (Fig. 3C, D). Blood cultures drawn on day one following thrombectomy showed no growth.

ClotTriever-mediated thrombectomy has been approved for the treatment of venous thrombosis [2–4]. It may prove difficult to differentiate benign, malignant, and infectious thrombi on imaging alone, and conventional percutaneous needle biopsy may lead to non-diagnostic sampling or injury to the adjacent neurovascular structures. This report demonstrates that large-volume specimens obtained via the thrombectomy device may provide diagnostic information regarding benign, malignant, or infectious etiologies with no additional time, materials, or risks. Additionally, while catheter-directed thrombolysis of septic thrombophlebitis may be contraindicated for the fear of overwhelming sepsis, the thrombectomy device may offer both diagnostic and therapeutic benefits via en bloc extraction of the infected thrombi with lower risk of dissemination or endotoxin release. Further studies are warranted to establish the effectiveness of ClotTriever-mediated sampling as the primary modality for endovascular biopsy.
Acknowledgements
Institutional review board approval was obtained for preparation of this report. There are no additional acknowledgements.

Declarations
Conflicts of interest E.J.M. is a scientific advisor and speaker for Biogen. J.F.B.C. is a consultant and speaker for Inari Medical, Guerbet, C. R. Bard, Argon Medical Devices, Boston Scientific, and NXT Biomedical. None of the other authors have identified a conflict of interest.

Human or Animal Rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.
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