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“Advanced Techniques and Considerations in Complex Inferior Vena Cava (IVC) Filter Retrieval”

Background: The retrieval of inferior vena cava (IVC) filters continues to present as a crucial and technically demanding skill within interventional radiology. Several common challenges upon IVC removal include filter migration, endothelial wall penetration, fractured filters, and filter tilt. Dwelling time length is a paramount determinant of success: the median dwell time for successful retrievals is 196 days as compared to the median dwell time of failed attempts at the 375-day mark. Thrombus formation can further hinder extractions by damaging filter structure and increasing procedural risk. In addition, filter design can play a significant role in complexity of procedures as closed cell filters are more susceptible to fracture, thus requiring a more advanced retrieval technique as opposed to open cell filters. Because these factors can have significant implications for retrieval outcomes, investigation of pre-procedural imaging for patient-specific approaches is necessary to best achieve sound removal.

Objectives: The main objective is to implement improved safety and efficacy for removal of complicated IVC filters through defining retrieval techniques tailored to case-specific scenarios. Through understanding key anatomic and technical factors that can impede the retrieval process and laying a framework for advanced removal strategies, we aim to further develop the margins of what can be an effective and secure filter removal.

Methods: A case-based review was conducted utilizing complex IVC retrieval imaging selected from institutional archives that are representative of common complications including strut fracture, endothelial implantation, filter tilt, vertebral penetration, and elongated dwell timing. Advanced retrieval techniques exhibited include the hangman technique, loop-snare realignment, tilted-filter straightening, wire loop-and-forceps sling modification, dissection technique, and filters that can be removed from the femoral approach. Procedural design highlights technique preference on the basis of filter structure (open cell vs. closed cell), clotting activity, and anatomical complexity. Contingency planning and procedural “point of no return” were paramount identifications when establishing a successful retrieval and prioritizing patient welfare.

Key Findings: Factors such as shorter dwell time duration and pre-operative investigations of complications were robustly correlated with successful IVC filter retrievals. Filter classification and imaging guided approaches and appropriate techniques. In order to minimize insult to caval integrity or risk of fragment deposition, a procedural “point of no return” was identified to best optimize each case assessment.

Conclusion: Overall, complex IVC retrieval is a multimodal process that involves a strategic framework rooted in anatomical and mechanical factors. Applications of appropriate techniques involve preprocedural investigations and postoperative management, which optimizes consistency in retrieval outcomes.