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Clinical Indication Appropriateness of Bilateral Lower Extremity Venous Exams

By: Breana Doyle & Kristina Horan

Abstract

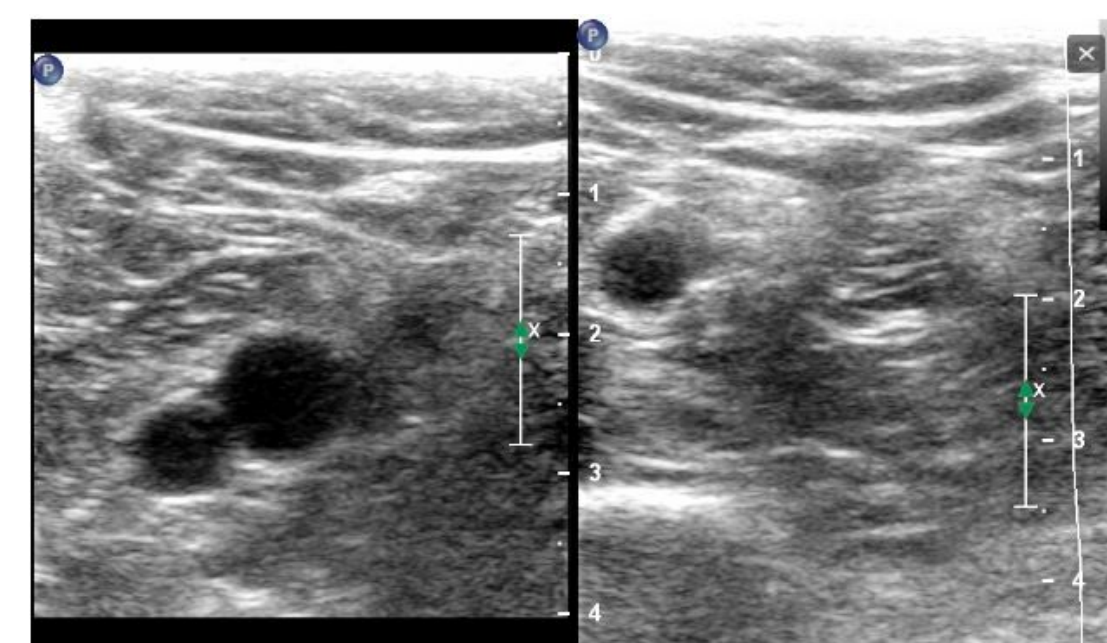
The purpose of this study was to evaluate the appropriateness of bilateral lower extremity venous exam orders. The study encompassed final reports of 216 bilateral lower extremity venous exams that took place in December 2021 from three separate medical facilities. The Centers for Medicare and Medicaid Services (CMS) Appropriate Use Guidelines for Non-Invasive Vascular Studies were used to determine if the exams were ordered appropriately. The results were 159 duplex exams were ordered appropriately and 57 were not appropriate. The findings concluded that a majority of the bilateral lower extremity venous exams were ordered appropriately.

Introduction

Venous duplex ultrasound is the diagnostic tool to evaluate extremity veins for deep vein thrombosis. A deep vein thrombosis (DVT) is "a medical condition that occurs when a blood clot forms in a deep vein" (Centers for Disease Control and Prevention, 2020). It is an aggregate of clotting factors that accumulates and turns into a solid state prohibiting blood flow. The clot typically develops in the "lower leg, thigh, or pelvis, but can also occur in the arm" (Centers for Disease Control and Prevention, 2020). It is important to recognize the symptoms and signs of DVT early on because the clot can break loose, travel into your bloodstream and becomes lodged in a pulmonary artery, blocking flow causing a pulmonary embolism (PE) (Mayo Clinic, 2020). When a "DVT and pulmonary embolism occur together it is called a venous thromboembolism (VTE)" (Mayo Clinic, 2020). Some non-specific signs and symptoms of a DVT include "swelling in the affected leg (rarely, swelling in both legs), pain (usually starts at the calf and feels like cramping or soreness), red or discolored skin on the leg, and a feeling of warmth on the affected leg" (Mayo Clinic, 2020). To assess the veins in a patient suspicious for DVT, a sonographer uses a transducer to visualize the vessel and uses pressure to check for compression. This is a key determinant of thrombus formation. The use of color and spectral Doppler analysis is also used to examine the blood flow in the vein, however compression is the most reliable diagnostic criteria for evaluation (Polak et al., 2012).

According to the Centers for Medicare and Medicaid Services (CMS) Appropriate use Guidelines for Non-Invasive Vascular Studies, patients are candidates for a DVT study when they present with the following symptoms including, but not limited to, "edema, tenderness, inflammation, erythema, hemoptysis, chest pain, dyspnea, unexplained lower extremity edema status, post major surgical procedures, trauma, other or progressive illness/condition, and unexplained lower extremity pain excluding pain of skeletal origin" (Centers for Medicare & Medicaid Services, 2019). CMS then makes an important distinction that a venous ultrasound exam is rarely medically necessary when the patient exhibits bilateral extremity edema in the presence of congestive heart failure (CHF), obesity, or arthritis (Centers for Medicare & Medicaid Services, 2019). This is significant to address because these disease processes can mimic DVT symptoms. A physician may face initial difficulties correlating symptoms to a specific cause, however it is considered inappropriate to order a venous exam for surveillance (Fowl, 1996).

The goal of this study was to determine if physicians are ordering bilateral lower extremity venous (BLEV) exams appropriately based on the patients signs and symptoms. The exams that were assessed were pulled randomly from the emergency department, inpatient, and outpatient orders.



Ultrasound Image from a venous duplex exam showing a compressible vein in the lower extremity. (Weinberg, 2018)



Ultrasound image from a venous duplex exam demonstrating a non-compressible vein, indicative of a deep vein thrombosis. (Weinberg, 2018).

Popliteal vein DVT ultrasound

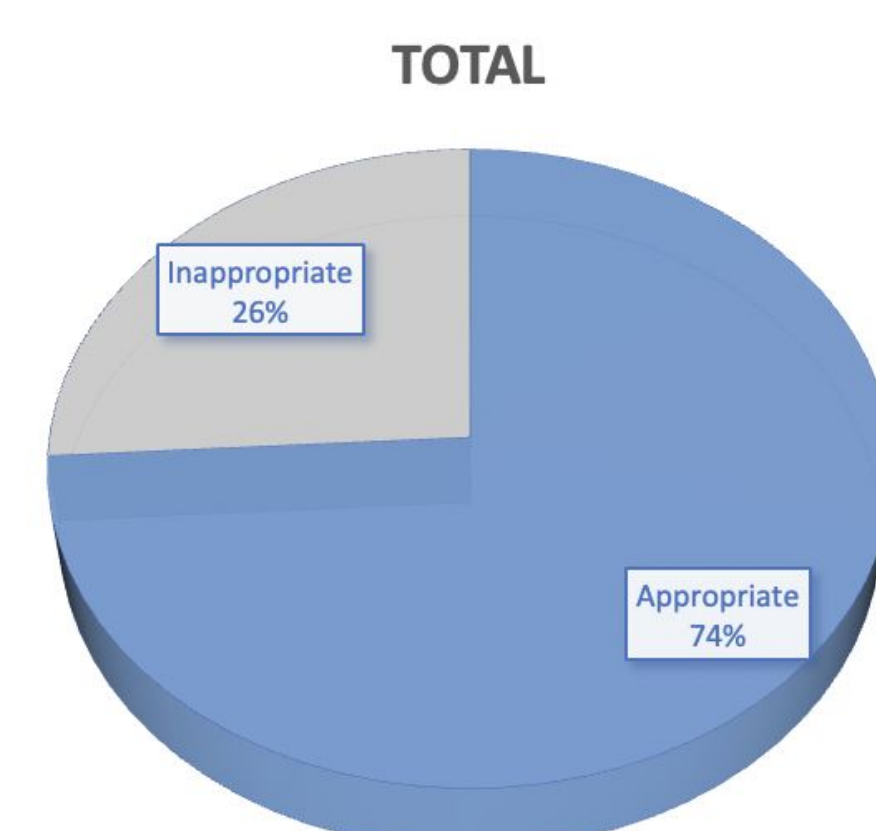
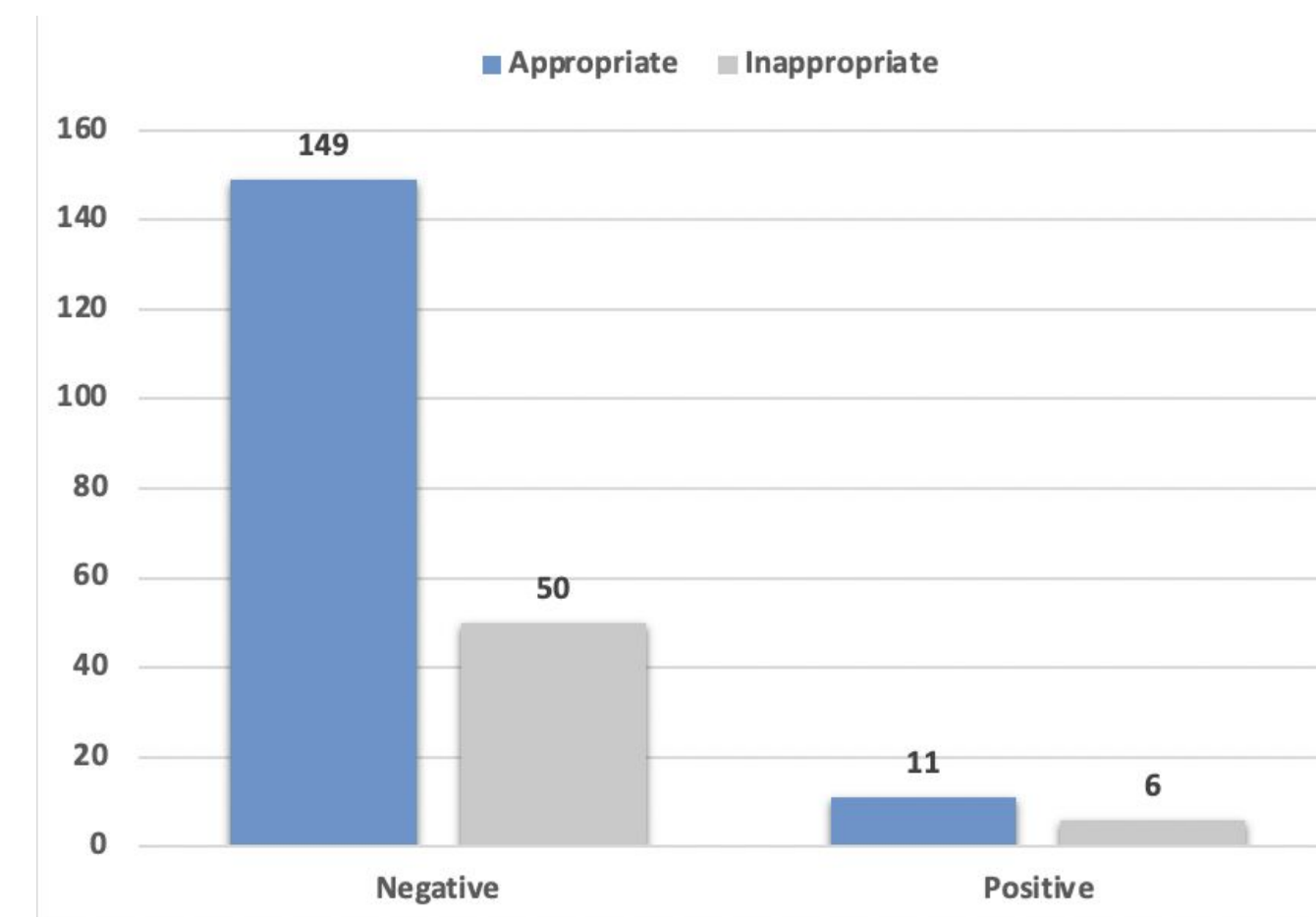
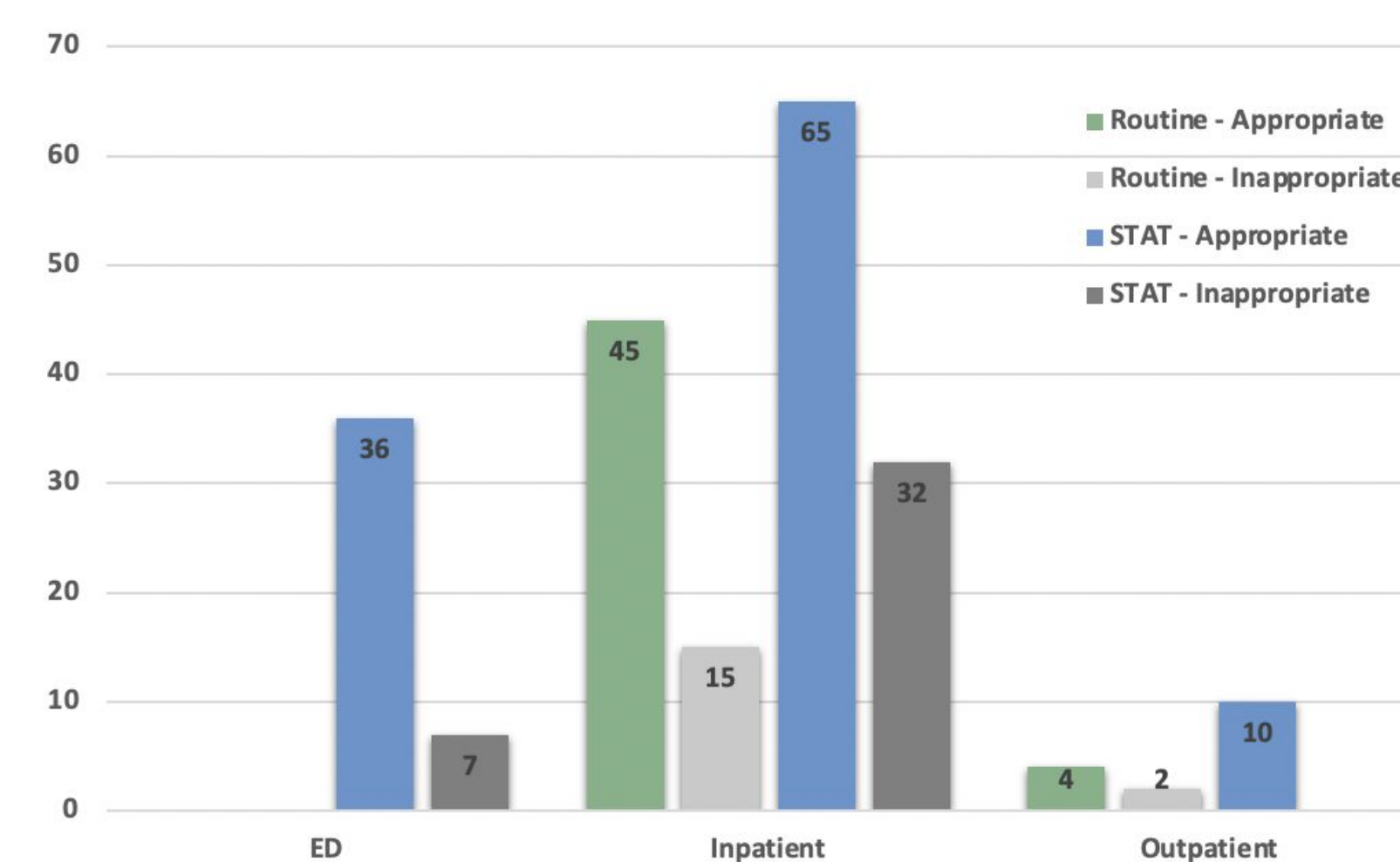
Methods

A retrospective research study was conducted looking back on previous random patients that had received bilateral lower extremity venous duplex ultrasound examinations from December 1st through December 31st, 2021. The study included the physician order requisition with exam indications and finalized diagnostic reports interpreted by a licensed radiologist. A review of total patient history was not included in the study and only considered the information related to the exam requisition and outcome. The orders that were reviewed consisted of both STAT (emergent) and routine inpatient, outpatient, and emergency room orders. The data was then compiled into a spreadsheet and then evaluated using the indications the physicians wrote against the CMS appropriate use guidelines.

Results

Physician prescription orders and resulting radiologic reports were reviewed for 224 patients seen at three separate medical facilities for bilateral lower extremity venous doppler ultrasound exams between the dates of December 1 through December 31, 2021. Eight patients were excluded from the data during the review due to vein mapping requests under the bilateral lower extremity venous doppler ultrasound order. A total of 216 patients met the criteria for the retrospective analysis. Demographic information on all 216 patients was not collected for the purposes of this research.

Information collected pertained to the physician's diagnosis on the bilateral lower extremity venous doppler ultrasound exam order requisition and whether the indication was appropriate using the Centers for Medicare and Medicaid Services Appropriate Use guidelines for Non-invasive Vascular Studies. Overall, 159 exams were ordered with appropriate indications under these criteria, and 57 contained inappropriate indications for the selected exam. Specifically, within this population, 43 were emergency department patients, 157 were inpatients admitted to various hospital floors, and 16 were outpatients. Routine priority totaled 66 patients while the other 150 patients were of STAT priority. The overall outcome of the bilateral lower extremity venous doppler ultrasound exam to assess for deep venous thrombosis showed 199 negative results consisting of 148 appropriate indications for the exam contrasted with 17 positive results, 11 of which had appropriate indications.



Discussion

Limitations

This research is subject to several limitations that should be considered when interpreting the data. The first limitation is the sample size used to support the assessment of inappropriate exam indications on lower extremity venous duplex ultrasound exams. As a related component to the sample size, the sample profile was restricted geographically. Secondly, the research analysis presented is extracted from narrow parameters used to deem physician order requisitions as appropriate or inappropriate. Lastly, the type of data points collected was a significant limitation due to time constraints. Information related to patient demographics and risk factors was not considered. Future research could benefit from a diverse sample profile and in-depth patient history to gain an accurate view of indication appropriateness.

Analysis

The use of lower extremity venous duplex ultrasound has become a frequently used method for detecting deep vein thrombosis (DVT) and venous thromboembolic disease (VTE), replacing venography, impedance plethysmography, and phleboreography in recent decades (Polak et al., 2012). The modality is a popular choice because it is non-invasive, cost-effective, and does not use ionizing radiation (Fowl et al., 1996). The duplex exam has a high sensitivity and specificity, 88-100% and 92-100% respectively, with little to no risks to the patient (Fowl et al., 1996) (Polak et al., 2012). The aforementioned advantages of venous duplex ultrasound allow it to be inappropriately ordered and misused by physicians. In addition to the advantages of venous duplex ultrasound, the non-specific symptoms of DVT and VTE largely factor into the overuse and excessive ordering of bilateral venous duplex ultrasound exams.

Out of the 56 (26%) total inappropriately ordered venous duplex ultrasounds, 34 of them were "rule out DVT" and similar phrasing on exam requisitions. This indication lacks clinical signs and symptom information necessary to be found appropriate by the CMS Appropriate Use Guidelines and implies the exam is being ordered in its absence. A study done by Fowl et al. (1996) of 2993 patients who received a lower extremity venous duplex ultrasound exam displayed similar results to the current research study. Fowl et al. (1996) found that when a lower extremity duplex ultrasound was performed for surveillance of DVT, 74.1% were negative for thrombus overall, 87.3% were negative in patients with associated risk factors, and a positive result for venous thrombus was recorded in 6.7% of patients. In our current research, "rule out DVT" as an indication for exam totaled 34 of the 56 (60.7%) inappropriately ordered venous duplex ultrasounds with 29 of the exams (85.3%) having a negative result for DVT.

Another common inappropriate indication seen on physician's orders was "elevated d-dimer", referring to the laboratory result commonly used to assess for clotting throughout the body by measuring fibrin degradation and other blood clot remnants in a blood sample. A venous ultrasound is unnecessary when d-dimer levels are within normal limits and a patient presents without DVT or VTE clinical symptoms. In the setting of abnormal d-dimer results, a patient's risk factors should be accounted for and scored using the Well's Criteria before ordering a venous duplex ultrasound to assess for the presence of thrombus. It is recommended that the Well's Criteria for clinical risk of DVT be used anytime a patient is suspicious for DVT, independent of other testing or assessments as well (Polak et al., 2012). A requisition with "elevated d-dimer" entered as a reason for the venous ultrasound was 11 out of the 56 (19.6%) inappropriately ordered. Only one out of those 11 (9.1%) yielded a positive result for DVT.

Clinical Characteristics	Points
Active cancer (patient receiving treatment for cancer within the previous 6 months or currently receiving palliative treatment)	+1
Paralysis, paresis, or recent plaster immobilization of the lower extremities	+1
Recently bedridden for 3 days or more or major surgery within the previous 12 weeks requiring general or regional anesthesia	+1
Localized tenderness along the distribution of the deep venous system	+1
Entire leg is swollen	+1
Calf swelling at least 3 cm larger than that on the asymptomatic side (measured 10 cm below tibial tuberosity)	+1
Pitting edema confined to the symptomatic leg	+1
Collateral superficial veins (nonvaricose)	+1
Previously documented DVT	+1
Alternative diagnosis at least as likely as DVT	-2

Table showing Well's Score criteria (Polak et al., 2012)

The remaining requisitions for lower extremity venous duplex ultrasound that had an inappropriate indication consisted of reasons related to superficial venous disease, venous insufficiency, or systemic symptoms of other disease processes such as orders for varicose veins or hyperlipidemia. Patients presenting with clinical signs and symptoms of possible DVT or VTE bilaterally should first be assumed to have a systemic cause such as congestive heart failure (Polak et al., 2012).

Clinical symptoms upon assessment for lower extremity DVT are most often pain and swelling unilaterally or bilaterally (Polak et al., 2012). In the review of the 216 order requisitions, indications related to those symptoms were the most common totaling 119 (55.1%), which are considered appropriate according to the CMS Appropriate Use Guidelines. Of those exam orders, 24 (11.1%) included both pain and swelling, 25 (11.6%) only stated pain, and 70 (32.4%) only stated swelling of the lower extremities. The number of positive DVT occurrences was 8 (6.7%) out of the 119 with pain and swelling as the reason for the exam. Fowl et al. (1996) reported similar findings, although higher, of 22.4% in patients with pain stated and 27.9% in patients with swelling stated. It is consistent with the assertion that clinical findings associated with DVT are poor indicators and are non-specific (Fowl et al., 1996).

Overall, this retrospective research of 216 patients who received a bilateral lower extremity venous duplex ultrasound to assess for DVT showed that the majority of exams were ordered appropriately with 160 (74%) exams meeting the CNS appropriate use criteria. In contrast, this is a higher result than a study performed by Stegheer et al. (2017) on 225 lower extremity venous ultrasounds performed in a vascular laboratory. Their research presented 117 (52%) exams as appropriate. However, the exams that were judged as appropriate resulted in an 82% positive result for DVT. The duplex ultrasounds ordered with an inappropriate indication had a 90.75% negative test result for DVT. Similarly, the current research aligns with Stegheer et al. (2019) with results indicating that inappropriately ordered exams had an 89.3% negative test result rate. A sharp contrast can be seen in the percentage of exams that showed a positive result for thrombus in the exams that were ordered with appropriate indications was 6.9%. This could possibly be attributed to the sample size and demographic influencing factors of each retrospective research.

Conclusion

The retrospective research into the appropriateness of bilateral lower extremity venous exam orders has shown most physician requisitions contain appropriate indications and information under CMS Appropriate Use Guidelines for Non-Invasive Vascular Testing. The results of this inquiry are similar to the findings in peer-reviewed published studies regarding the use of venous ultrasound for deep vein thrombosis detection and venous thromboembolic disease. The use of ultrasound in the detection and management of venous disease in the extremities is not projected to decrease in the future and remains the most recommended exam due to the advantages of the modality.

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