ST. VINCENT CHARITY MEDICAL CENTER

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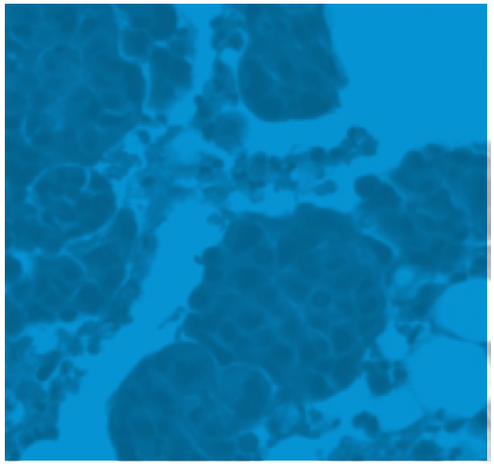

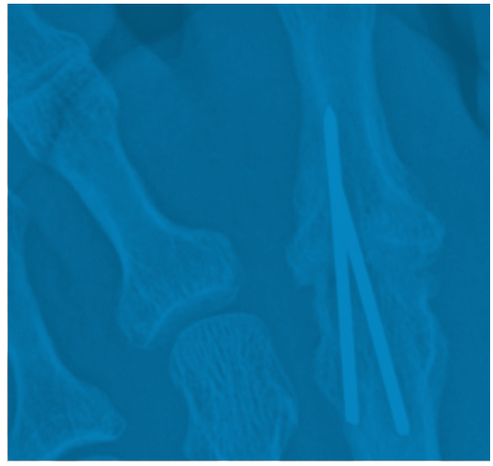

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ST. VINCENT CHARITY
MEDICAL CENTER

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FROM THE EDITOR IN CHIEF

I am sure some of you watched Oscars of 2016. This was a competitive year with lots of good movies and much excitement about candidates to win the best actor, actress or documentary movie awards and others. However, I think we all agree that the bigger subject of 88th academy award was discrimination against African-American actors and movies.

Apparently no African-American actor was nominated for top awards and there was no top movie with significant minority involvement nominated either. But one way or the other the Academy found a way to address this criticism and take initial steps in alleviating this problem.

The host, Chris Rock, an African American who was appointed by academy had several comments and funny jokes about it and there were many famous African-American presenters, perhaps more than usual reminding us of this event as a beginning of a new era. I have no doubt next year we will witness a lot of changes. I thought it was very right and smart move.

Then I asked myself why medicine does not take this approach. We are a big industry similar to the movie industry and we have had similar problems for decades. We are not diverse enough. The leadership and key players of medicine have remained more or less the same despite the fact that population has changed drastically in United States. A report by the Association of American Medical Colleges (AAMC) addressing the faculty of medical schools in U.S. identified 27,886 white professors compared to 541 African American and 553 Hispanic professors. This is a ratio of less than 2 percent.

According to the 2010 census 16.3 percent of the U.S. population is Hispanic and 12.2 percent is African American. There has not been any change in trend of these ratios for several decades. I think this has contributed to our problem with health disparities to certain extent.

But the question is: who is going to fix it? Government, or insurance companies? I hope not. I think it is time for us, similar to Hollywood to take the first step and start an upward trend. This needs a fix from inside out and needs it fast.

Keyvan Ravakhah, MD, MBA, FACP
Editor in Chief

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Lisfranc ligament rupture in an elite level gymnast, with a fast-track post-operative course and return to competition within 3.5 months

By **Michael B. Canales, DPM, FACFAS, Director of the Division of Podiatry, St. Vincent Charity Medical Center, Podiatric Surgical Residency; Kartick Patel, DPM, Resident, Post-Graduate Year 2; Mark C. Razzante, DPM, MA; Coleman O. Clougherty, DPM, MA**


Figure 1


Figure 2

Figures 1 & 2. Diastasis between 1st and 2nd rays at the level of the tarsometatarsal joints on plain film radiographs and computed tomography scan with a visible fleck fracture of the second metatarsal base.

ABSTRACT
Injuries to the tarsometatarsal joint are common in sports; however, presentations vary in the athletic population. There also exists a great deal of variability in post-operative management. A 22-year-old male collegiate gymnast sustained a Lisfranc ligament rupture during the final preseason intrasquad, just two weeks prior to the competitive season of his senior year. The patient promptly underwent open reduction internal fixation. The team athletic trainer worked closely with the senior author/surgeon during the post-operative rehabilitation, and the elite level gymnast returned to competition in 117 days to complete his collegiate career on a positive note.

Video link: https://www.youtube.com/watch?v=yw-S1EX2aG4

LEVEL OF EVIDENCE
Level IV

INTRODUCTION
Injury to the tarsometatarsal joints accounts for approximately 0.2% of all fractures in the body, with an incidence of 1/55,000 cases per year[1]. Lisfranc injuries can be subtle and misdiagnosed. Approximately 20% of Lisfranc joint injuries are overlooked on initial anteroposterior and oblique radiographs[2]. Nunley and Vertullo reported a case series of 15 athletes who sustained Lisfranc injuries. Approximately half of the patients who had initial non-weightbearing radiographs that appeared normal later demonstrated diastasis on weightbearing films[3]. It is paramount to promptly recognize this injury to avoid mismanagment.

Lisfranc injuries occur due to direct or indirect trauma. Traditionally, high-energy injuries are typically associated with direct trauma, where the foot is hyperplantarflexed, as in motor vehicle accidents[4]. In athletes, midfoot sprains are one of the most common injuries, including injury to the Lisfranc complex. The mechanism of injury includes low-energy trauma with a twisting force to the foot. Fasciszewski et. al. discovered that of the 60% of patients who sustained low-energy trauma, greater than half of these injuries were sports related[5].

Gymnastics is one of the highest injury producing sports and ranks high among the sports related injuries that require surgery[6]. Foot injuries sustained by gymnasts are common. In 14 foot and ankle injuries studied by Ceroni et. al. five were Lisfranc injuries as result from a fall from the balance beam or vault[7]. Of these gymnasts in the series, only one was able to return to competitive sport[8]. Clearly, Lisfranc injuries can be debilitating and career-ending.

There exists controversy in the surgical management of Lisfranc injuries between open reduction internal fixation versus arthrodesis of the involved joints. Despite appropriate initial treatment, painful post-traumatic osteoarthrosis can still develop. Chilvers et. al. have found that patients who underwent open reduction internal fixation ultimately require arthrodesis as a salvage procedure[9]. Concurrently, some surgeons recommend arthrodesis as primary treatment. At the time of this publication, little evidence exists discussing management of Lisfranc injuries in elite level gymnasts.

CASE STUDY
A 22-year-old male collegiate gymnast sustained a Lisfranc ligament rupture during the final preseason intrasquad on December 16, 2013, just two weeks prior to the competitive season of his senior year. Semi-weightbearing radiographs demonstrated diastasis of the 2nd metatarsal base and medial cuneiform. Computerized tomography (CT) scan demonstrated diastasis at the Lisfranc joint (Figures 1 & 2).

The gymnast's initial surgical consultation recommended arthrodesis of the first and second tarsometatarsal joints, which would require a prolonged post-


Figure 3


Figure 4

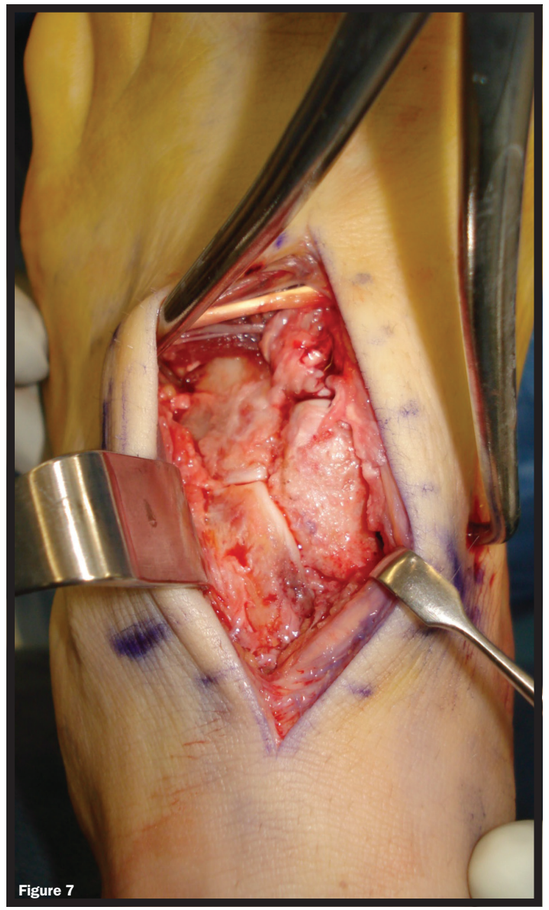
Figure 7

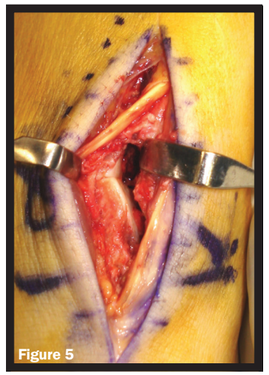
Figure 5

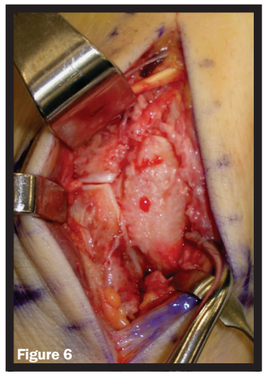
Figure 6

operative course that would require him to sacrifice his senior year of competition and consequently the end of his collegiate career. Red shirt year is based on criteria whereby the student-athlete may not have participated in more than two contests or 20 percent of the team's completed contests/dates of competition due to illness or injury[10]. However, this was not an option for him.

In an effort to compete during his senior year of competition, the gymnast sought a second opinion from the senior author (MBC) and was consented for open reduction internal fixation and counseled on a fast-track post-operative course. In conjunction with the team athletic trainer, the patient understood that removal of fixation and arthrodesis may be necessary in the future.

OPERATIVE TECHNIQUE

The patient was brought into the operating room and placed on the operative table in supine position. His left lower extremity was then prepped and draped in usual aseptic manner. Utilizing fluoroscopy the first and second metatarsal cuneiform joints were identified and a linear incision was made between the two metatarsals, just medial to the neurovascular bundle which was identified with pulse-doppler device (Figures 3 & 4).

Anatomic dissection was performed down to the periosteum and the neurovascular bundle was protected and retracted laterally for the duration of the case. A subperiosteal dissection was performed of the first and second metatarsal cuneiform joints as well as the intercuneiform joint of the medial and central cuneiforms. The disrupted Lisfranc ligament was identified along with soft tissue hematoma interposed within the Lisfranc joint complex (Figures 5, 6 & 7).

No cartilage damage was observed during the procedure. Following lavage with normal sterile saline, bone reduction forceps were used to anatomically reduce the joint complex and confirmed under multiple fluoroscopic imaging angles as well as clinical inspection. Guide wires were placed and position was confirmed with multiple fluoroscopic views (Figure 8).

Two 4.0 solid fully threaded cancellous screws were inserted. The first screw was inserted across the intercuneiform joint following anatomic reduction followed a second screw transversing from lateral 2nd metatarsal base to the dorsal one-third of the medial cuneiform medial boundary (Figure 9). The bone reduction forceps were removed and force was applied in the sagittal and traverse planes clinically and fluroscopically to confirm position and stability of the anatomically reduced joints.

The incision was irrigated and the pneumatic ankle tourniquet was released. Hemostasis was achieved and meticulous closure in layers was then performed with absorbable sutures with care being taken to protect the neurovascular bundle and avoid incarceration with ligatures. Incisions were dressed with a topical antibiotic ointment and non-adherent dressing, followed by the application of a short leg fiberglass compression cast.

Post-operatively, the patient was discharged home the same day following surgery with strict non-weightbearing instructions for 3 weeks in a short-leg-fiberglass cast and encouraged to perform plantarflexion and dorsiflexion against the cast for mechanical deep venous thrombosis (DVT) prophylaxis and to minimize muscular atrophy of the intrinsic and extrinsic musculature. The team athletic trainer worked closely with the senior author during the post-operative course. After four weeks, he began aquatic therapy for rehabilitation. He underwent five weeks of rehabilitation and gradually resumed competition on March 28, 2014 without pain, 40 days after surgery (Figure 10). He competed in the NCAA tournament on April 11, 2014, 117 days after surgery. There were no complications in his post-operative course and hardware was removed at 4 months based on the patient's request (Figure 11).

Video link: https://www.youtube.com/watch?v=yw-S1EX-2aG4

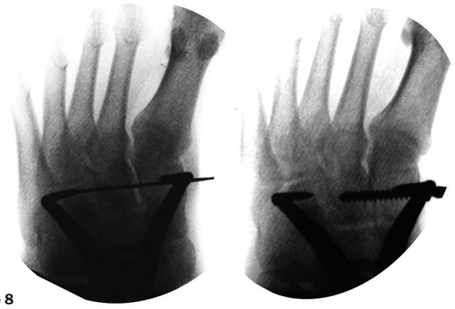
Figure 8

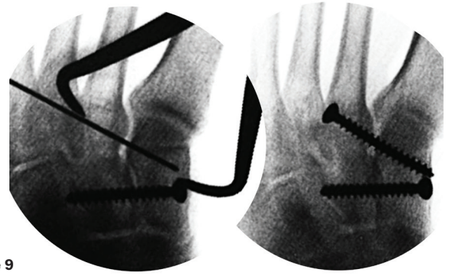
Figure 9


Figure 10


Figure 11

Figures 3 & 4. Dorsoplantar fluoroscopy was utilized to identify osseous anatomy and plan screw placement.
Figures 5 & 6. Diastasis of the Lisfranc complex and anatomic reduction achieved with a bone tenaculum.
Figure 7. Anatomic reduction across the path of Lisfranc ligament was achieved with a bone tenaculum.
Figure 8. Screw fixation across the intercuneiform joint following anatomic reduction. A cannulated drilling technique was performed, the guide wire was removed, and a solid 4.0 cancellous screw inserted.
Figure 9. The second screw was placed from the base of the second metatarsal to the medial cuneiform following anatomic reduction with the bone tenaculum.
Figure 10. Weightbearing dorsoplantar radiograph two months post-operatively demonstrating maintenance of anatomic reduction.
Figure 11. Weightbearing dorsoplantar lateral radiograph five months post-operatively demonstrating maintenance of anatomic reduction after removal of hardware.

DISCUSSION

Treating athletes with subtle Lisfranc injuries presents a unique challenge to surgeons. Prompt recognition and treatment of these injuries is imperative to minimize loss of training time, competition, and significant long-term disability. The general consensus in the literature indicates anatomic reduction of the Lisfranc joint is vital for optimal outcome. Nevertheless, differences in opinions exist as to whether open reduction internal fixation or primary arthrodesis is the treatment of choice for optimal clinical outcomes for the patient.

Open reduction internal fixation is recommended for treatment of displaced Lisfranc joint injuries due to better functional outcomes[11]. However, persistent pain secondary to instability and posttraumatic arthrosis of the tarsometatarsal joint has appeared to shift the paradigm toward primary arthrodesis as a treatment option[11,12]. As previous studies have suggested, between 40-94% of patients who underwent open reduction internal fixation developed posttraumatic arthritis[13,14,15]. Thus, there is an increase in severity of pain with a mean AOFAS midfoot score of 57.1 points in the open reduction internal fixation group compared to patients who underwent arthrodesis with mean score of 86.9 points[11].

Furthermore, there is an increased rate of post-operative sequela in the open reduction internal fixation group resulting in a reoperative rate of 79% compared to 20% in the arthrodesis group [12,14,16]. Kuo et. al. found similar results, stating purely ligamentous Lisfranc injuries following open reduction internal fixation have resulted in post-operative arthritis. Current research outcomes support primary arthrodesis as a primary treatment for Lisfranc joint injuries[15]. This is largely due to decreased

Lisfranc ligament rupture

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Table 1: A comparison of postoperative courses for open reduction internal fixation of Lisfranc injury: The traditional (Bloome and Clanton) course with the fast-track postoperative course of the Athlete in this case.

TIMELINE	TRADITIONAL POSTOPERATIVE COURSE *a*	FAST-TRACK POSTOPERATIVE COURSE *b*
Immediate	Compressive dressing with short leg splint, NWB	Jones compression bandage with fiberglass shell
3 weeks	NWB CAM boot	NWB, passive dorsiflexion and plantarflexion against fiberglass shell
4-6 weeks	NWB CAM boot Passive STJ and ankle joint ROM	Aquatic therapy for grip strengthening
6 weeks	Removal of percutaneous pins to lateral rays, if applicable	Gradually resumed gymnastics, specific movements including trampoline and landings from a weight of nearly nine feet
8 weeks	Progressive WB in CAM boot Transition from CAM boot to rigid-sole shoe	Returned to high level gymnastics competition at Conference Championships
3.5 months	Continue weightbearing in rigid-sole shoe	Competed at NCAA National Championships
4 months	Removal of hardware Return slowly to athletic participation	Removal of hardware and continued high level gymnastics 3 weeks following surgery

NWB – Non-weightbearing
ROM – Range of Motion

a Bloome DM, Clanton TO: Treatment of Lisfranc Injuries in the Athlete. Techniques in Foot and Ankle Surgery 1(2): 94–101, 2002
b Fast-track postoperative course designed by primary author

necessity for reoperation, as well as improved clinical outcome scores when compared to open reduction internal fixation.

While only time will tell if the patient may require arthrodesis, anatomic open reduction and internal fixation with a fast-track post-operative course allowed an elite level gymnast to resume competition on March 28, 2014, 103 days after surgery since sustaining a Lisfranc ligament rupture on December 16, 2013 (Table 1). This accelerated post-operative course would not otherwise be possible with an arthrodesis procedure as was discussed in the initial surgical consultation. As arthrodesis procedures necessitate a longer post-operative course, it would inadvertently inhibit the patient to return in time to complete his collegiate career. Equally important, the close collaboration and open communication between the senior author, the athlete and trainer was paramount in achieving the accelerating the post-operative course.

Obviously, further studies are needed with long term follow up to determine if open reduction and internal fixation with an aggressive post-operative course is recommended in both athletic and non-athletic populations.

CONCLUSION

It is essential to be highly aware of injury to the tarsometatarsal joints when evaluating patients who have midfoot pain and swelling. Liberal use of weight-bearing radiographs is appropriate in these injuries. Appropriate management, including a prompt and thorough surgical consultation is required to improve the long-term functional outcome as illustrated in this high-level athlete gymnast.

ACKNOWLEDGEMENT

Gratitude to the esteemed athletic training staff at the Ohio State University for their collaboration and effort in assisting the athlete during his accelerated post-operative course.

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Type I Hyperlipoproteinemia : A rare entity

By **Astrit H. Hajdari, MD; Tarek Khader, MD; Ronak Bhimani, MD; Jayantilal Bhimani, MD; and Keyvan Ravakhah, MD, MBA, FACP**

LEARNING OBJECTIVES

1. To identify type I hypertriglyceridemia, a rare inherited disease.
2. To identify the diagnostic studies/elements for hypertriglyceridemia.

INTRODUCTION

According to the Lipoprotein particles that accumulate in the blood, Frederickson classified hyperlipoproteinemias into 5 types, I-V. A good history taking including family history, along with age of the development of symptoms, physical findings, and a few basic labs are helpful tools in determining the diagnosis of mixed hyperlipidemia. However, sometimes these diagnostic elements are not enough and therefore, more specific studies are needed to determine the type of these disorders.

CASE PRESENTATION

A 39-year-old gentleman with history of hyperlipidemia presented to the doctor's office for abdominal pain. The pain was mostly pronounced on the left side with no associated gastrointestinal symptoms. He was being treated by the primary doctor for severe hypertriglyceridemia. The patient had also history of diabetes mellitus type 2, asthma and hypertension. Family history was positive for hyperlipidemia with eruptive xanthomas on paternal uncles, and different cancers in family members. The patient smoked 1-2 cigars monthly and drank 6-12 beers 4 times a week.

Upon examination, he was found to have splenomegaly, 4 cm below the costal margin. No hepatomegaly and no chronic liver disease stigmata were noted. His skin examination was distinctive for innumerous eruptive xanthomas on various parts of his extremities (Figures 1,2,3).


Figure 1


Figure 2


Figure 3

Basic labs showed Hgb of 11.8. Platelets were initially 126 and other indices were normal. Kidney function was normal. Liver function was normal except for a mildly elevated AST of 54. His coagulation profile was unremarkable. Lipid profile was striking for Triglycerides 743, Cholesterol 258, HDL 28, LDL could not be calculated. Amylase and Lipase were normal.

The patient had CT of the abdomen and pelvis with IV contrast prior to the admission that showed 5.2 X 4 cm mass in the right lobe of the liver and splenomegaly. The spleen measured 20 cm cranial-caudally with multiple low attenuation lesions up to 2.6 cm. The ultrasound showed fatty liver and a heterogeneous echogenic pattern of the liver.

CT guided biopsy of the hepatic lesion was performed which showed macro and micro vesicular steatosis, with 60% of hepatocytes involved. Splenectomy was performed and microscopy showed "congested splenomegaly" with no fatty infiltrates (Figure 4). The spleen gross measured 21.5 x 13 x 8.5 cm (Figure 5). The capsule was intact, purplish with multiple foci of yellow discoloration. No focal lesions were grossly identified on the spleen.

Lipoprotein Electrophoresis revealed Cholesterol of 1,275 mg/dL, Triglycerides 11,665 mg/dL, HDL Cholesterol 30 mg/dL, LDL Cholesterol Direct 8 mg/dL,

Type I Hyperlipoproteinemia

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VLDL Calculated 1,237 mg/dL. It appeared turbid.

DISCUSSION

At the initial office visit, the patient's lipid panel showed a total cholesterol of 473, triglycerides of 3638 and HDL of 22. The tuberous xanthomas occurred first at the age of 19. Treatment for the hypertriglyceridemia was initiated about 10 years ago. When the patient was compliant with his treatment, his lipid panel improved and, with noncompliance with his meds and diet, his levels went back up. His family history was interesting. None of his uncles had been diagnosed with coronary heart disease. Family pedigree chart (Graph 1).

There are 5 types of hyperlipidemias. The familial mixed hyperlipidemias are inherited in an autosomal form. Type I hyperlipoproteinemia (severe Hypertriglyceridemia), generally present in the childhood or young adults. It has an estimated incidence 1/1,000,000. These individuals have defect in LPL, Apo C-II or Apo A-V. LPL catalyzes the hydrolysis of the 1- and 3-ester bonds of triglycerides present in chylomicrons and VLDL. For full activity LPL requires activation by Apo C-II. Apo -V modulates the LPL activity. Genetic deficiency or inactivity of either above proteins results in elevated plasma chylomicrons. These patients manifest with hepatosplenomegaly and eruptive xanthomas.

The hepatosplenomegaly is result of chylomicrons uptake by reticuloendothelial cells in the liver and spleen. Some of these patients never develop pancreatitis. Generally, coronary heart disease is not a feature of familial chylomicronemia. LPL enzymatic activity or its concentration can be determined after Heparin infusion, which releases the LPL from being bound to the endothelium. To differentiate the activity of LPL from the hepatic lipase, the study can be performed in the presence of high ionic strength, protamine sulfate, or LPL antibody to inhibit LPL activity. The deficiency of Apo C-II or the presence of an Apo C-II variant (mutation), is identified by isoelectric-focusing or two-dimensional gel electrophoresis of plasma. The normalization of the LPL activity in additional of the exogenous Apo C-II Cofactor indicates Apo C-II deficiency.

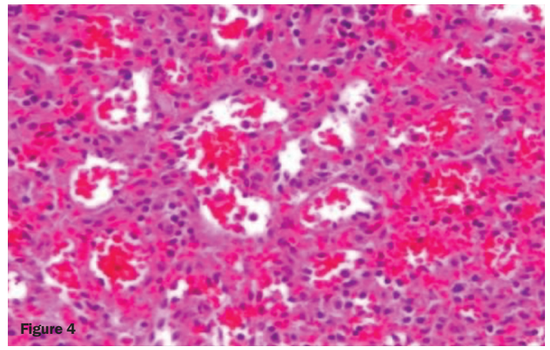

Figure 4

Figure 4

CONCLUSION

Our patient has both clinical and laboratory findings of type I hyperlipidemia. The lipoprotein electrophoresis helped us in making the diagnosis. In type I hyperlipidemia the cholesterol level is one-fifth to one-tenth of the triglyceride level and our patient's cholesterol level was 1,237 mg/dl and the triglyceride level was 11,665 mg/dl. Type I hyperlipidemia is characterized for triglyceride levels >1000 mg/dl. Our patient had elevated levels of chylomicrons, the plasma color was turbid, and his VLDL level was elevated which is typical for type I hyperlipidemia. The HDL level usually around 20 mg/dl and direct LDL levels are less than 50 mg/dl. For a definitive diagnosis the tests described in the discussion section and the molecular sequencing of the genes can be used.

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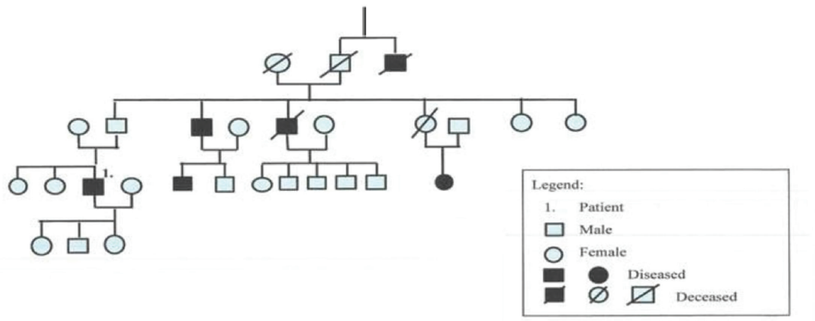
Graph 1



Neoplastic Cardiac Tamponade secondary to Metastatic Large Cell Carcinoma of the Lung: Case Report and Review of the Literature

By **Mohamad Khaled Soufi, MD; Fazel Dinary, MD; Muhammad Raihan Malik, MD; Kevin L. Cooper, MD; Ghassan A. Moasis, MD; Carrie A. Bassett, DO; and Keyvan Ravakhah, MD, MBA**

Affiliations — 1, 2, 3, 6 and 7: **Department of Medicine, St. Vincent Charity Medical Center, Cleveland, OH;** 4: **Department of Pathology, St. Vincent Charity Medical Center, Cleveland, OH;** 5: **Department of Cardiothoracic Surgery, St. Vincent Charity Medical Center, Cleveland, OH**

ABSTRACT

Neoplastic disease can involve the pericardium as primary or secondary tumors by direct extension, hematologic or lymphatic seeding and can present in different ways. Lung cancer is the most common primary tumor to cause a neoplastic pericardial effusion. Other primary tumors that can cause neoplastic pericardial effusion as well are breast cancer, esophageal cancer, leukemia and lymphoma, melanoma and mesothelioma.

In our paper, we present a patient who came in with a complaint of worsening shortness of breath and diagnosed with a neoplastic cardiac tamponade secondary to metastatic large cell carcinoma of the lung along with reviewing the literature about neoplastic pericardial disease.

CASE

A 70-year-old Caucasian woman with past medical history of hypertension, dyslipidemia, chronic renal insufficiency and asthma came in to the emergency room complaining of worsening shortness of breath. She was hypotensive with a blood pressure of 89/59 and tachycardic with a heart rate of 109. Physical examination revealed that the patient was in moderate distress, with positive jugular venous distention, tachycardia, muffled heart sounds, expiratory wheezing and few bilateral basal lung crackles.

Chest x-ray showed severe cardiomegaly with moderate bilateral pleural effusions Figure 1. CT scan of the chest showed large pericardial effusion with mass effect on the right ventricle suspicious for cardiac tamponade, moderate right pleural effusion and occlusion of the right middle lobe bronchus with complete atelectasis of the right middle lobe suspicious for an endobronchial lesion Figure 2.

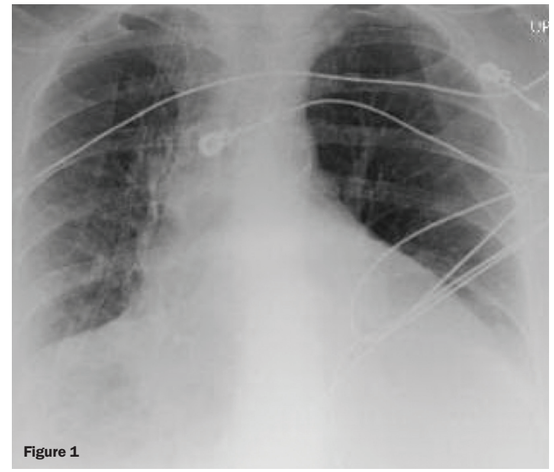


Figure 1

Figure 1: Chest x-ray showing severe cardiomegaly with moderate bilateral pleural effusions.

Patient underwent an urgent echocardiography which confirmed the presence of cardiac tamponade along with right ventricular diastolic collapse Figures 3-4. She was urgently taken to operation room where she got percutaneous subxiphoid pericardiocentesis and pericardial window under local anesthesia. Vital signs improved immediately with a blood pressure of 140/90 and a heart rate of 80. Pericardial fluid analysis showed glucose of 74 mg/dL, total protein of 6 g/dL and LDH 2077 U/L. The fluid was negative for gram stain, aerobic and anaerobic cultures and for acid-fast bacilli but it was positive for malignant cells Figures 5-6 and the pericardial tissue biopsy was positive for malignant cells as well Figure 7 consistent with metastatic adenocarcinoma consistent with lung as primary.

Later on patient underwent bronchoscopy with endobronchial biopsies and bronchoalveolar lavage. Endobronchial biopsy showed malignant cells intravascularly Figure 8 of which the histologic appearance was similar to pericardial effusion cells and consistent with adenocarcinoma. However, immunohistochemical staining of the current biopsy was more consistent with a poorly differentiated squamous cell carcinoma. Because of this discrepancy in staining patterns, the biopsy was best classified as large cell carcinoma and the patient final diagnosis was neoplastic cardiac tamponade secondary to metastatic large cell carcinoma of the lung.

DISCUSSION

The prevalence of neoplastic pericardial disease has always been variable over the world. In necropsy series, the pericardium has been found to be involved in 5 to 40% of patients with malignant disease[1,2,3].

The retrospective analysis of Mayo Clinic from the years 1979 to 2000 reported a decrease of cancer prevalence among symptomatic pericardial effusion, but mainly due to an increase of pericardial effusion due to postoperative procedures or perforations from invasive procedures, rather than a decrease of malignant pericarditis cases[4]. Neoplastic etiology of 13% and 7.3% has been reported in a Spanish study[5] for the years 1998-2002 and an Italian study[6] for the years 1996-2003 respectively.

Neoplastic Cardiac Tamponade

(cont. from previous page)

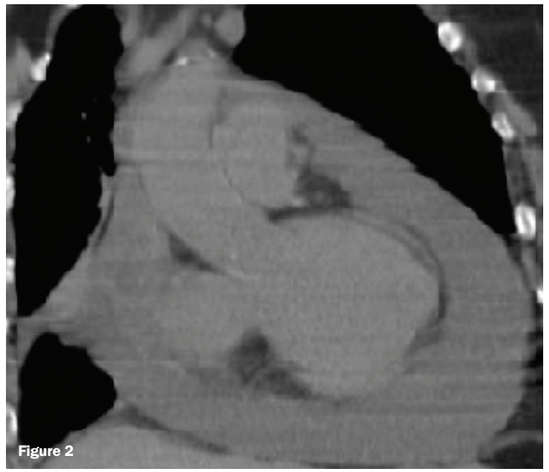
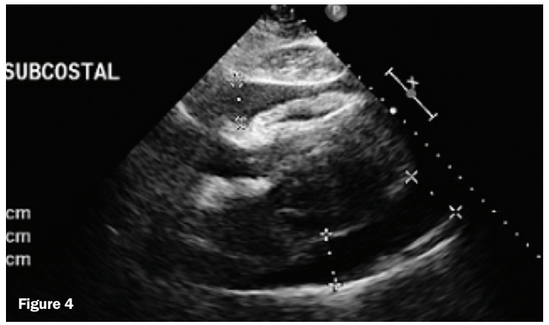


Figure 2


Figure 3



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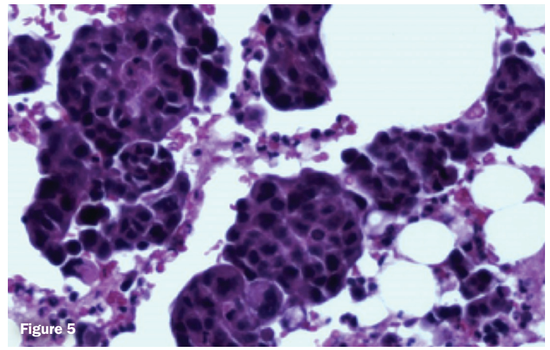
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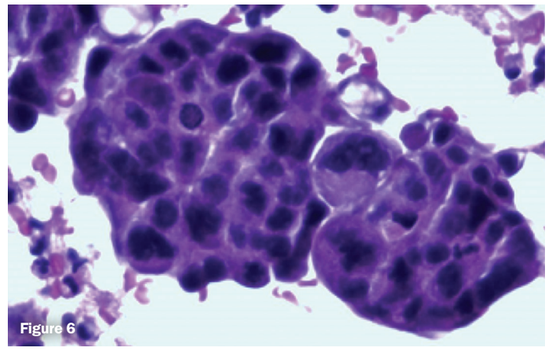
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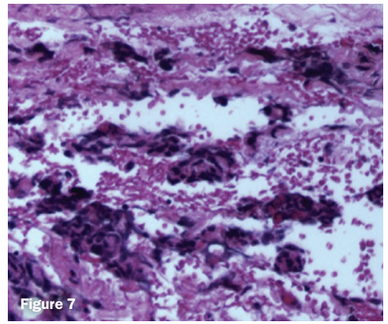
Figure 7

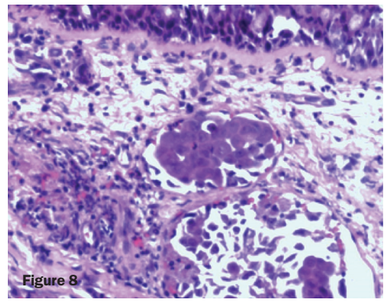
Figure 8

Figure 2: CT scan of the chest showing large circumferential pericardial effusion.
Figure 3: Echocardiography showing pericardial effusion and right sided heart compression.
Figure 4: Echocardiography showing pericardial effusion.
Figure 5: H&E 100x pleural fluid showing clusters of malignant cells.
Figure 6: H&E 200x pleural fluid showing clusters of malignant cells.
Figure 7: H&E 100x pericardial biopsy showing clusters of malignant cells.
Figure 8: H&E 100x endobronchial biopsy showing intravascular malignant cells.

Of patients with lung cancer, 33% have pericardial metastases at autopsy[7]. One third of cases of pericardial metastases are caused by lung cancer. Breast cancer causes 25% of pericardial effusions and hematological malignancies (leukemia, Hodgkin disease, non-Hodgkin lymphoma) cause 15% of cases of malignant pericardial effusions[7].

Neoplastic pericardial disease can manifest as pericarditis, pericardial effusion, cardiac tamponade or pericardial restriction. For the majority of patients, clinical manifestations of neoplastic pericarditis are absent. When clinically significant, neoplastic pericarditis presents as acute pericarditis with or without pericardial effusion. When presented as pericardial restriction, the diastolic filling is limited by the restricted inelastic pericardium, which is inflamed, scarred, or calcified and thicker than normal with all the corresponding symptoms and signs. Neoplastic pericardial effusion might be the first sign of malignant disease[8] and is considered a serious complication of cancer and is associated with a high morbidity and mortality, especially when presents as cardiac tamponade.

Dyspnea or fatigue may be the initial symptoms[9]. Other symptoms are cough, chest pain, orthopnea and weakness. Signs of pericardial tamponade as an extreme presentation include tachycardia, pulsus paradoxus, elevated jugular venous pressure, and hypotension with classical findings of pericardial tamponade of pulsus paradoxus, pericardial rub and Kussmaul's sign occurring only in 30%, 12% and 5%, respectively[10,11].

Electrocardiograms in neoplastic pericardial disease can show ST segment elevation, nonspecific T wave changes, diminished QRS amplitude in all leads and a variation in the amplitude of the P wave, atrial fibrillation and QRS complex in successive beats on EKG, known as electrical alternans, especially in large effusions and cardiac tamponade. Chest radiography may show widening of the cardiac silhouette, pleural effusion. Echocardiography can be very helpful in confirming presence and magnitude of pericardial effusion, evaluating right and left ventricular function and detecting any abnormal septal motion (described with bulges of the intraventricular septum during inspiration into the left ventricle due to an increased systemic venous return to the right ventricle and a limited expansion of the right ventricular free wall due to the increase in intrapericardial pressure), early right ventricular (has higher specificity) or late atrial (has higher sensitivity) diastolic collapse when the intrapericardial pressure exceeds intracavitary pressure.

Cardiac computed tomography and cardiac magnetic resonance imaging are increasingly being used in the diagnosis of pericardial diseases. They are very sensitive in the detection of any effusion whether its free or loculated and can also be used to measure the pericardial thickness[12]. Besides being neoplastic, patients with cancer might have pericardial effusion secondary to other etiologies including radiation, hypoalbuminemia, uremia, drugs, or idiopathic where the role of pericardial fluid cytology and pericardial biopsy becomes vital.

Pericardial fluid cytology has sensitivity of 92% and specificity of 100%[13]. In cytology-negative samples of pericardial fluid, measuring tumor markers such as carcinoembryonic antigen (CEA), neuron-specific enolase (NSE), serum cytocheratin 19 fragments (CYFRA 21-1) and carbohydrate antigens CA 125, CA 15-3 and CA 19-9 may be helpful as well[14]. Pericardial biopsy or pericardoscopy with visualization of the pericardial surface and guided biopsies of suspicious areas may increase the sensitivity of diagnosing pericardial effusions of neoplastic origin. The most definitive test for the diagnosis of cardiac tamponade is equalization of diastolic pressures between all cardiac chambers on right-heart cardiac catheterization. However, it is not to necessary to use this test to diagnose tamponade.

Many treatment goals should be sought concomitantly including complete removal of fluid especially in cardiac tamponade and thereby relieving symptoms, preventing recurrence, treating the local neoplastic disease along with approaching the primary tumor if the neoplastic pericardial disease is secondary with the aim of prolonging survival.

Clinically symptomatic patients especially those with cardiac tamponade should get percutaneous subxiphoid pericardiocentesis as the treatment of choice. Treatment options include percutaneous pericardiocentesis, subxiphoid pericardial window, pericardiectomy, intrapericardial instillation of the antineoplastic drug, pericardial sclerosis, pericardotomy by thoracotomy or video-assisted thoracoscopy, or systemic chemotherapy and radiation therapy mainly for neoplastic pericardial disease secondary to breast cancer, leukemia and lymphoma. Many factors including relief of tamponade, minimal invasiveness, cost, morbidity, safety, shortened hospitalization for patients with advanced disease, and patient's prognosis before tailoring any treatment plan.

CONCLUSION

The majority of neoplastic pericardial disease cases found to be secondary in origin. Many primary tumors in the body can metastasize to the pericardium affecting it differently ranging from neoplastic pericarditis to neoplastic cardiac tamponade.

A high degree of clinical suspicion is required as presentation and diagnostic investigation can be equivocal.

Many treatment options are available, but similar to the presentation of our patient, the presentation of metastatic pericardial disease can be cardiac tamponade with hemodynamic instability, a situation that necessitates an urgent life saving pericardiocentesis to be done as soon as possible before any further diagnostic or therapeutic steps can be undertaken.

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Address for Correspondence:
Mohamad Khaled Soufi, MD
Department of Medicine
St. Vincent Charity Medical Center
2351 E. 22nd Street
Cleveland, OH, 44115
E-mail: khs.1985@hotmail.com
Phone: (313) 409-1923

Overuse of CT Pulmonary Angiography in evaluation of patients with Suspected PE in the Emergency Department

By **Mariam Diab, M.D.; Ritika Ohri, M.D.; Keyvan Ravakhah, M.D. Department of Medicine, St Vincent Charity Medical Center, Cleveland, Ohio**

ABSTRACT

Background

Pulmonary embolism (PE) is a common, serious and potentially fatal complication of thrombus formation within the deep venous circulation. It is the third leading cause of death with an average of 650,000 PE-related deaths in the U.S. annually. Emergency department (ED) physicians often face the dilemma of establishing the diagnosis of PE in patients who present with signs and symptoms suggestive of pulmonary embolism such as dyspnea, chest pain, unexplained tachycardia, syncope, hyperventilation and other more nonspecific complaints. However, CTPA, the gold standard test is not risk free nor cheap .

Objectives

A quality improvement project to assess the percentage of CT Pulmonary Angiography (CT-PA) which could have been avoided by the use of Wells score in ED patients with suspected PE.

Methods

A retrospective cohort study involving chart review of patients admitted to hospital through ED with suspicion of PE and received CT-PA. Wells score was calculated for every individual patient and was compared between positive and negative patients.

Results

50% (192) of patients were assigned low risk Wells score and 1 out of them was diagnosed with PE. 45.57% (175) of patients were assigned medium risk Wells score and 9 out of them were diagnosed with PE. 4.43% (17) of patients had high risk Wells score and 6 out of them had positive PE.

Conclusion

CTPA is ordered in low-risk patients frequently, which exposes them to side effects and adds to the medical expenses.

INTRODUCTION

Pulmonary embolism (PE) is a common and potentially lethal disease. Emergency physicians must assess patients with nonspecific symptoms such as chest pain, dyspnea, or palpitations, and decide whether testing for PE is warranted. Algorithms incorporating clinical prediction rules and/or D-dimer testing have been developed to guide the evaluation of patients presenting with suspected PE. Two such algorithms, the Wells score coupled with D-dimer testing (Wells/D-dimer), and the Pulmonary Embolism Rule-Out Criteria (PERC), have demonstrated high negative predictive value (NPV) in large prospective ED studies. A score < 2 is classified as low risk Wells score, score between 2-6 is classified as medium risk Wells score and those with score above 6 are classified as high risk Wells score. This quality improvement study is implemented to improve the standard of care in the hospital to avoid tendency to rush into ordering imaging studies in patients with suspected pulmonary embolism.

Implementation of these algorithms in clinical practice is inconsistent. As a result, low-risk patients may be subjected to unnecessary imaging leading to increased ED length of stay (LOS), preventable health care expenditures, and in the case of contrast-enhanced computed tomographic pulmonary angiography (CT-PA), avoidable health risks of radiation exposure, contrast-related complications and also the cost of medical care.

METHODS

Study Design

We performed a retrospective cohort study of patients who underwent CT-PA for suspected PE in ED.

Study Setting and Population

This study was conducted on 384 patients presented to ED between time period January 2013 to April 2014 at St Vincent Charity Medical Center, Cleveland, Ohio.

Inclusion Criteria:

Patients aged 18 years or older who underwent CT-PA for suspected PE as part of their ED evaluation.

Exclusion Criteria:

Diagnosis of acute PE or DVT within 4 weeks of ED presentation.

DATA ANALYSIS

Categorical data were summarized by counts and percents, between Wells probability group differences (positive versus negative for CT Chest Results) were analyzed by the chi-square test of contingency table data or Fisher's exact test as appropriate. Quantitative BMI were summarized by sample means and standard deviations, with the 95% confidence intervals for the sample means also shown for Wells probability groups. Statistical significance was taken as $p < 0.05$. The statistical analysis was performed with SPSS version 22 software (IBM Corp., IBM SPSS Statistics for Windows, Version 22.0, Released 2013. Armonk, NY: IBM Corp.).

RESULTS

Of 384 suspected pulmonary embolism subjects available for analysis only 16 (4.15%) were diagnosed with PE. 64.67% were female patients. The mean age was 41+/-20 years and most of the population were African American.

Patient characteristics, including demographics, pertinent past medical history, thrombotic risk factors, and presenting signs and symptoms, are listed in Table No.1. The patients in the study were predominantly middle aged and female. A number of patients had risk factors for venous thromboembolism (VTE), including a history of prior DVT or PE, active malignancy, recent surgery or trauma, immobilization, or exogenous estrogen use. The most common presenting signs and symptoms were shortness of breath (40.9%), chest pain (42.5%), and lower extremity pain or swelling (1.30%).

Wells score characteristics of PE-positive and PE-negative patients are shown in Table No.2. Two of Wells score parameters 'suspected DVT' and 'alternative diagnosis is less likely than PE' were statistically significant among the two groups.

DISCUSSION

CTPA is frequently utilized test. It is expensive and carries potential risk. In this study we assess the percentage of CT-PA that could have been avoided by use of validated algorithms for the evaluation of patients presenting to the ED with suspected PE. We found that use of Wells would have safely reduced the number of CT-PA performed by 50%.

When applying the Wells score to our study population, 50% of patients were classified as "PE Low Risk" based on scores <2. Out of all these low risk patients one person had PE. The study shows that at least medium risk wells score should be established before proceeding to work up the patient for pulmonary embolism as the presenting symptoms of PE can mimic a lot of other clinical syndromes, which will decrease the patient's risk of exposure to unnecessary testing.

A criticism of the Wells score is that it is not entirely objective, as the algorithm contains the subjective variable "an alternative diagnosis is less likely than PE." This may allow for clinician judgment to enter into the decision rule, placing the patient into a higher or lower risk category given the three-point value to this variable. In addition, other variables may be more predictive for PE than those that are currently included in validated algorithms. A recent multi-center study of almost 8,000 patients showed that in symptomatic patients being considered for possible PE, non-cancer-related thrombophilia, pleuritic chest pain, and family history of VTE increased the probability of PE or deep vein thrombosis. None of these variables are part of the Wells score.

The use of CT has increased dramatically in the United States over the past two decades, and approximately 14% of all emergency patients now undergo CT scans during their ED visits. This not only increases resource use, financial costs, and LOS, but also increases patient exposure to contrast media and radiation exposure risks. The median effective dose for chest CT for suspected pulmonary embolism is 10 mSv.

An increased risk of cancer has been demonstrated among long-term survivors of the Hiroshima and Nagasaki atomic bombs, who received exposures of 10 to 100 mSv. Contrast-induced nephropathy is another recognized adverse consequence from contrast-enhanced imaging, and leads to increased morbidity and mortality. A recent study of ED patients receiving intravenous contrast for CT demonstrated an 11% rate of contrast-induced nephropathy. Other unintended consequences of contrast-enhanced imaging, such as significant allergic reactions and extravasation of contrast, are rare but clinically important.

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Validated clinical decision rules have the potential to reduce unnecessary CT-PA and its associated adverse consequences. However, such rules were underutilized in our study and in other settings. One potential barrier to use of these rules is that physicians may feel that clinical gestalt is similar or superior. Several studies have compared clinical gestalt assessment to the Wells score and have found comparable results in assessing pretest probability. Moreover, some clinicians may err on the side of ordering unnecessary CT-PA in low-risk patients for fear of litigation. Runyon et al. demonstrated that only half of physicians who are familiar with commonly used clinical decision rules use them in more than half of appropriate patients. In addition, the physicians' spontaneous recall of the rules was low to moderate.

More work is needed to understand the

| continued on p.19

Table 1: PATIENT CHARACTERISTICS

Characteristic	Suspected P.E n (%)
Number of patients	384
Age Mean (age +/- SD)years	41+/- 20 yrs
Sex	
Male	136 (35.41%)
Female	248 (64.58%)
Signs and Symptoms	
Chest Pain	163 (42.45%)
Shortness of breath	157 (40.89%)
Leg pain and swelling	5 (1.3%)
Hemoptysis	5(1.3%)
Medical History and thrombotic risk factors	
Malignancy hx	21 (5.47%)
DVT /P.E hx	38 (9.89%)
Recent Trauma /Surgery within the last 6 weeks	30 (7.81%)
Exogenous hormone therapy	10 (2.6%)
Immobilization within the past 6 weeks	12 (3.13%)

Table 2: WELLS CRITERIA AND DISTRIBUTION OF CHARACTERISTICS (TOTAL N= 384)

	PE positive N=16	PE negative N=368	p-value
1. Suspected DVT	48 (13.04%)	6 (37.50%)	0.0153*
2. An alternative diagnosis is less likely than PE	138 (37.70) [1]	15 (93.75%)	< 0.0001***
3. Heart rate >100	111 (30.16%)	4 (25.00%)	0.77
4. Immobilization	12 (3.26%)	0 (0%)	> 0.99
5. Previous DVT/ PE	34 (9.24%)	4 (25.00%)	0.0622
6. Hemoptysis	5 (1.36%)	0 (0%)	> 0.99
7. Malignancy	20 (5.43%)	1 (6.25%)	0.60

* denotes statistically significant ($p<0.05$)
***denotes very highly statistically significant ($p<0.001$)

Patients transfers from a community hospital to a tertiary center; characteristics and outcomes

Primary investigator: **Andrey Strunets MD, PGY3.**
Research mentor and Faculty Advisor: **Keyvan Ravakhah MD, MBA.**
IRB approval: **Approved**

ABSTRACTS

Transfers of patients between hospitals happens frequently all across healthcare centers in the United States. We reviewed all transfers from our hospital to our sister tertiary center and analyzed characteristics of these transfers. Although insurance and cost very rarely played a role in transfers, appropriateness of them were questionable in several cases. Our review revealed several other factors including comfort, legal and communication issues are as important as severity of the illness together with inadequacy of available treatment in transferring center.

INTRO/OBJECTIVES

Optimizing resources and efficiency of hospital care with patient satisfaction is a paramount of hospital economy. Today inter-hospital transfers of patients are among the routines of the daily business of community hospitals; however, the transferring process may lead to ineffective use of hospital and community resources and suboptimal patient outcomes. Analysis of the transfer processes has not been extensively studied before. Literature search did reveal only very limited studies of the process of patients transfers, that were mostly concentrated on presence of insurance and mortality benefits, and typically reviewed only subgroups of patients[1,2,3,4,5]. Transfers necessity, as well as timing of the transfers were not previously studied.

In the study we wanted to reveal what medical and non-medical factors were affecting transfers from a community teaching hospital to a tertiary center. Knowing this information, will help on further optimization of transferring services.

METHODS AND MATERIAL

Cleveland's University Hospital (UH) is the one of the referral centers for the St. Vincent Charity Medical Center (SVCMC). Significant numbers of transfers from the SVCMC are directed to the UH main campus.

We performed retrospective analysis of the transfers by reviewing the actual charts of the SVCMC and UH transferred patients. We limited our study to the transfers to one hospital, as it was the only referral center with shared medical records.\

Collected information was grouped by following categories: business vs non-business hours transfer, day of the week, ICU versus RNF transfer, main diagnosis, the reason for transfer, what was expected to be done, and what was done.

RESULTS

Charts of the patients who were transferred during a two-year period starting from December 2012 to December 2014 were reviewed. Sixty-six patients were identified and entered to our study.

Ninety four percent of transferred patients had health insurances. This was similar to all the patients who were admitted to SVCMC (96%) and national average of 95%[6].

Of all transfers from SVCMC to UH, ICU transfers comprised 33% of transfers.Only 29% of transfers happened during the business hours, the rest happened either after hours or on weekends.

Looking further at distribution by the weekdays we found that 18% of transfers occur on the weekends. If equal distribution of transfers during the week is assumed – it was a surprisingly low number since expected number would have been almost twice (29%). Furthermore, it was noted that when Friday transfers were added to weekends, number of transfers more than doubled and became 42%. Twenty-four percent of transfers happened on Fridays, a significantly higher than expected number. No other significant fluctuations in transfers rates were noted in relation to weekdays or holidays (state and federal).

A distribution of transfers by subspecialty reveal prevalence of GI cases - 24%, total surgical cases - 35%, of which neurosurgical subgroup was 15%. In neurosurgical transfers intra-cerebral pathologies such as bleeding and/or mass lesions were dominant. Reasons for surgical transfers varied from the need for surgical back up for interventional radiologist to complex cardio-thoracic cases like intraseptal cardiac mass or need for immediate valve repair. Subspecialty distribution is shown in the Graph 1.

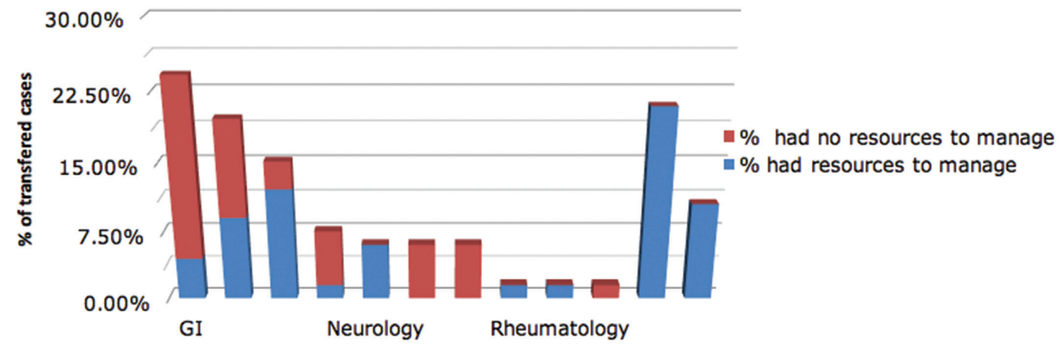
We were also able to determine the ultimate results of transfers, whether or not planned management was fulfilled.

We categorized results of transfers in two subgroups. First group was assessing whether the expectation for transfer were met (i.e. consultation, surgery, specific therapy, etc.). The second group evaluated whether SVCMC had resources to manage these patients the same way they were managed in the UH or not.

It was noted that in 73% of cases, management after transfer to the UH did meet the expectations for transfer (the first group). That said, 27% of the cases were approached differently and were managed either conservatively or with different type of procedure. In these cases referral diagnosis was not confirmed or intervention was found unnecessary or non-urgent with subsequent referrals for elective procedures or follow up as outpatients. In 11% of cases, patients' code status was changed to DNR-Comfort Care (DNR-CC) and they were either referred to hospice care or expired within the period of admission.

Assessing the ability of SVCMC to manage patients the way they were managed in UH, we found unexpectedly high numbers. We have noted that in 52% of cases transferred, management did not include any intervention or consult that would not be available at SVCMC. More than half of patients transfers theoretically could have been managed at SVCMC.

Graph 1



Looking to the group by subspecialties it was found that for surgical transfers, the management was conservative in 6 of 13 cases (46%), or 9% of overall transfers.

These numbers were even higher in the neurosurgical group 8 of 10 patients (80%) who were managed medically. For two of them code status was changed to DNR-CC, and for one patient surgery was postponed as it was declared non urgent.

Out of 4 oncology patient transfers only 1 was started on chemotherapy, 1 was discharged home with recommendations to follow up as outpatient, and other 2 patients were referred to hospice care.

In the subgroup of GI transfers 13 of 16 patients were managed as expected and requested procedures were done (81%).

There was an interesting finding in Interventional Radiology subgroup. In 2 cases of 5 radiological intervention were deferred and patients were taken to OR for extensive surgeries. One patient was managed medically without any intervention.

What needs to be noted is that out of 66 transfers to UH, 14 cases were transferred due to unavailability of service at primary hospital at the moment that decision was made - i.e. physician or technologist were not available, covering physician was not certified to perform requested procedure or a particular equipment was not available.

DISCUSSION

Presence or absence of healthcare insurance didn't play a role in the transfers. Yet, there can be a bias as like many other teaching institution, UH accepts all medically relevant patients regardless of the presence or absence of insurance. This might be different for transfers to for-profit facilities[2].

Somewhat surprising was a discovery on time distribution shift of transfers with significant surge of transfers on Fridays, and subsequent drop in numbers over the weekends. We did not find a documented rationale or confounder responsible for that trend. That said, we may speculate that convenience for physicians could play a role in this finding. How did it affect patient outcomes as well as patient's satisfaction, remained unanswered.

When we researched the subsequent management of the transfers, we found that SVCMC had all the necessary setting to manage more than half (52%) of transfers. With that in mind we still have a significant number of patients (14%) who were transferred due to unavailability of services. Furthermore 11% of patients were transferred due to the attending or patient's request. Necessity of these transfers brings the question, whether we explained adequately to those patients our ability to treat them at SVCMC without a need to transfer?

What is very important to note is that among the subspecialties for referral - there were no Internal Medicine and Pulmonology-Critical Care. Those transfers for Endocrinology, Neurology and Rheumatology referral, total of 6 (9%) were due to unavailability of the services at a time of admission. GI service had the highest percentage of "being appropriate," as in only 19% of case management would be possible at the host hospital.

Lack of OB/GYN and Electrophysiology consultants generated 5 transfers (8%). There were total of 14 cases (21%), that were transferred due to unavailability of service.

CONCLUSION

In our research, we have found that number of transfers and subsequent management varied by subgroups. We discovered that 73% of all cases received expected care at tertiary center. Chart review of patients' management at UH showed, that in 52% of cases it did not include any comprehensive procedure or consultant service that would be unavailable at the host hospital, and in theory these cases could be managed without a need to transfer.

The largest number of referrals came from all the surgical teams combined - 23 (35%). In general surgical group 46% of the patients transferred to the UH were managed conservatively. In the neurosurgical subgroup this percentage was even higher, 80%. On the other hand, there were 16 GI cases (24%), and thus group had the lowest percent of cases, when management at UH was conservative and did not differ from what theoretically could be done here at SVCMC, only 19%. Patients' requests to transfer were another major contributor for the UH referrals, 7 cases or 11%. Our review of those cases did not reveal any need for resources that were not available at SVCMC. Electrophysiology, OB/GYN, Neurology, Endocrinology and Rheumatology subcategories comprised 17% of cases, these transfers were made due to unavailability of services at the SVCMC (temporarily for the last 3 subgroups, 9%). In all the subspecialty groups total of 21% of transfers were done due to unavailability of services. In the Radiology subgroup only 1 of 5 cases was managed conservatively. In the Hematology Oncology subgroup, only 1 out of 4 cases was started on chemotherapy during stay in UH.

Analyzing timing of transfers we expected to see equal distribution over the weekdays, but we discovered an unexpected decline in transfers over the weekends 18% instead of expected 29%. Further investigation revealed a surge of transfer on Fridays 24% - a 10% increase from expected number. We were not able to | continued on p.19

Bringing the Past to the Future: Can K-Wires and Steinmann Pins Make a Comeback?

Primary Author: **Michael B. Canales, DPM, FACFAS, Chief of the Division of Podiatry, St. Vincent Charity Medical Center, Podiatric Surgical Residency**

Corresponding Authors: **Grace Chuang, DPM, Resident, Post-Graduate Year 2, St. Vincent Charity Medical Center, Podiatric Surgical Residency; Mark C. Razzante, DPM, MA, St. Vincent Charity Medical Center, Podiatric Surgical Residency; Coleman O. Clougherty, DPM, MA, St. Vincent Charity Medical Center, Podiatric Surgical Residency**

ABSTRACT

Kirschner wire and Steinmann pin fixation have been widely utilized due to their simple and inexpensive qualities. When it comes to fixation options, surgeons have an abundance of choices for implantable devices. This is a pragmatic view of a variety of applications of Kirschner wire and Steinmann pin fixation.

INTRODUCTION

Various devices have been advocated for skeletal fixation including screws, plates, monofilament wire, intramedullary devices, staples, and external fixators. Screw fixation is common; however, screws may induce cortical fracture, which can result in inadequate fixation especially in the face of osteopenic bone. This can induce loss of stability at osteotomy or syndesis sites leading to significant postoperative complications. Plate fixation is also common but has disadvantages in cost and previously reported accuracy of courting to irregular bony surfaces. Plates can also obscure radiographic visualization of fracture healing and trabeculation across an arthrodesis site.

Martin Kirschner first introduced metallic pins in 1909 as a method of stabilization across fracture and arthrodesis sites[1]. Taylor later described the use of Kirschner wire (K-wire) fixation in 1940 and believed the use of K-wires would decrease motion at the site of intended fusion[2]. Yu, et al. described the use of two K-wires for first interphalangeal joint arthrodesis of the hallux to prevent migration, loosing, and rotation to enhance stabilization of arthrodesis surfaces[3]. This technique effectively allowed surgeons to maintain stable fixation even in patients with compromised bone density.

Fritz Steinmann of Bern, Switzerland introduced Steinmann pins as a method of applying skeletal traction to the femur with two pins applied to the femoral condyles[4]. Coughlin and Mann utilized two 3.5-millimeter (9/64 inches) double-ended threaded Steinmann pins to salvage failed Keller-type resection arthroplasties with success in each patient with relief of preoperative pain and cocked up hallux deformities[5]. Mah and Banks demonstrated a predictable and reproducible technique for first metatarsophalangeal joint fusion with K-wire fixation and immediate ambulation[6].

In 1989, the lock pin K-wire technique for fixation of Austin-type osteotomies became popularized[7]. This technique effectively eliminated the tendency of pin migration and increased stability. Two lock pins can be used in patients with compromised bone stock. The lock pin fixation technique has been employed for a variety of applications such as Austin-type osteotomy, first metatarsophalangeal joint arthrodesis, tailor's bunionectomy, Lapidus arthrodesis, and triple arthrodesis[8].

The aim of this article is to shed light on applications of K-wire and Steinmann pin applications.

Digital Arthrodesis

Smaller K-wires (1.1-1.6 mm or 0.045 - 0.062 inches) can be employed in an "all inside" technique for digital arthrodesis when they are drilled in a retrograde fashion down the medullary canal into the base of the proximal phalanx (Figure 2). Radiographically and visually the MPJ is inspected. The wire is bent and cut allowing approximately half a centimeter distal to the bend apex. The cut remnant is then used to create a pilot hole in the intermediate phalanx and the phalanx is then positioned over the bent portion of the inserted wire. Collateral ligaments are then scrupulously repaired for added stability.

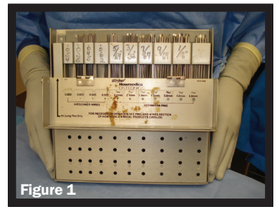


Figure 1. K-wires vary in size from 0.07 mm -1.6 mm (0.028 - 0.062 inches) and Steinman pins vary in size from 2.0 mm – 4.8 mm (5/64 – 3/16 inches), both implants are available with options for threaded or smooth designs. They are traditionally nine inches long but are also available in four inch length.

K-WIRE DIAMETERS

Inches	Millimeters
0.028"	0.7mm
0.035"	0.9mm
0.045"	1.1mm
0.062"	1.6mm

STEINMANN PIN DIAMETERS

Inches	Millimeters
5/64"	2.0mm
3/32"	2.4mm
7/64"	2.8mm
1/8"	3.2mm
9/64"	3.5mm
5/32"	4.0mm
0.177"	4.5mm
3/16"	4.8mm

Metatarsophalangeal Arthrodesis and Lesser Osteotomies

When combined with a 1st MPJ arthrodesis, a 2nd MPJ arthrodesis is an option in geriatric patients with low ambulatory demands with a dislocated 2nd MPJ refractory to previous surgical intervention, as an alternative to digital arthrodesis, or as an alternative to digital amputation. K-wires are placed across the arthrodesis site and cut flush with the dorsal cortex of the bone or in lock-pin fashion (Figure 3).

For a dorsiflexory or shortening osteotomy of a metatarsal, a K-wire (1.1-1.6 mm or 0.045 - 0.062 inches) can be driven from dorsal to plantar and cut flush with the dorsal cortex for transverse plane stability (Figure 4). The length of the wire for a traditional Weil osteotomy is 10-12 mm, which can be marked with a skin scribe prior

Figure 2. Smaller K-wires (1.1-1.6 mm or 0.045 - 0.062 inches) can be employed in an "all inside" technique for digital arthrodesis when they are drilled in a retrograde fashion down the medullary canal into the base of the proximal phalanx. Radiographically and visually the MPJ is inspected. The wire is bent and cut allowing approximately half a centimeter distal to the bend apex. The cut remnant is then used to create a pilot hole in the intermediate phalanx and the phalanx is then positioned over the bent portion of the inserted wire. Collateral ligaments are then scrupulously repaired for added stability.

Figure 3. When combined with a 1st MPJ arthrodesis, a 2nd MPJ arthrodesis is an option in geriatric patients with low ambulatory demands with a dislocated 2nd MPJ refractory to previous surgical intervention, as an alternative to digital arthrodesis, or as an alternative to digital amputation. K-wires are placed across the arthrodesis site and cut flush with the dorsal cortex of the bone or in lock-pin fashion.

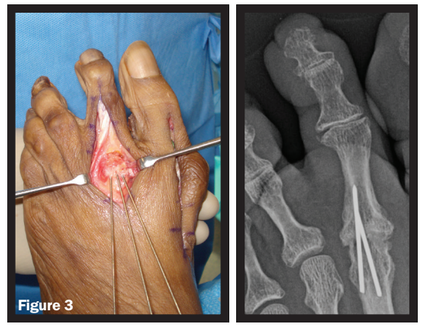


Figure 4. Using two full-length Kirschner wires or Steinman pins (1.6mm or 0.062 inches), a combined 1st MPJ arthrodesis and IPJ arthrodesis can be performed with axial placement of the wires and removed once syndesis has been achieved.

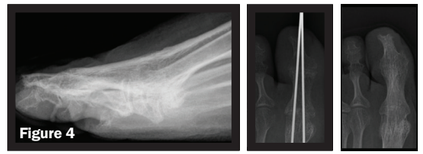


Figure 5. For a dorsiflexory or shortening osteotomy of a metatarsal, a K-wire (1.1-1.6 mm or 0.045 - 0.062 inches) can be driven from dorsal to plantar and cut flush with the dorsal cortex for transverse plane stability. The length of the wire for a traditional Weil osteotomy is 10-12 mm which can be marked with a skin scribe prior to placement of the wire. In addition, using tactile sensation will allow the surgeon to feel penetration of the plantar cortex.

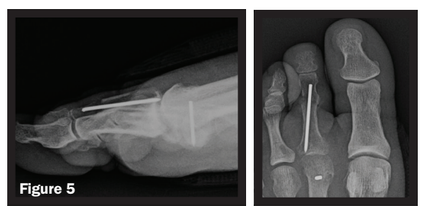


Figure 6. Injuries to the Lisfranc complex can be reduced percutaneously or in an open reduction with lock pin Kirschner wires (1.6 mm or 0.062 inches).

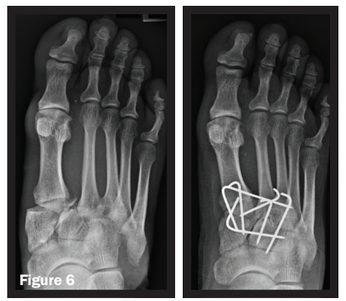


Figure 7A. A case of significant architectural deformation secondary to Charcot Neuroosteoarthropathy. The patient was free of infection with a significant equinovarus deformity and obliteration of the rearfoot joints ongoing for 5 years. Over that time span the patient was only able to ambulate with crutches placing no weight on the left lower extremity.

Figure 7B. Steinman pins 2.0-3.0 mm (5/64 – 1/8 inches) were employed to stabilize the sizeable joints of the rearfoot/ankle. Exit of the tibial cortex is intended to improve boney purchase and enhance stability following a wedge osteotomy resection.

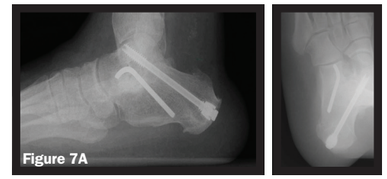


Figure 7C. A stable fibrous union with definitive correction of the equinovarus deformity. The patient is able to ambulate in a diabetic shoe with a build up without the use of assistive devices.

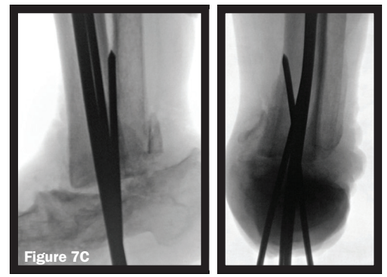


Figure 8. Subtalar joint arthroseses can be performed utilizing Steinman pins 2.0 - 3.0mm (5/64 – 1/8 inches) placed across the joint and cut flush with the bone or in utilization of a lock pin or sta-pin technique[11] against the lateral talar process to serve as a benchmark for position as well as a second point of fixation.

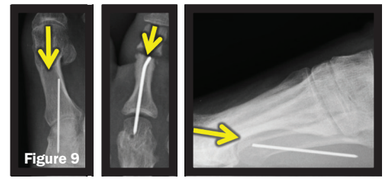


Figure 9. A common complication of K-wire or Steinman pin use is implant migration.

Bringing the Past to the Future

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to placement of the wire. In addition, using tactile sensation will allow the surgeon to feel penetration of the plantar cortex.

Double Arthrodesis in the First Ray

Using two full-length Kirschner wires or Steinman pins (1.6mm or 0.062 inches), a combined 1st MPJ arthrodesis and IPJ arthrodesis can be performed with axial placement of the wires and removed once syndesis has been achieved (Figure 5).

Lisfranc Fracture/Dislocations

Injuries to the Lisfranc complex can be reduced percutaneously or in an open reduction with lock pin Kirschner wires (1.6 mm or 0.062 inches) (Figure 6).

Subtalar Joint Arthrodesis

Subtalar joint arthroseses can be performed utilizing Steinman pins 2.0 - 3.0mm (5/64 – 1/8 inches) placed across the joint and cut flush with the bone or in utilization of a lock pin or sta-pin technique11 against the lateral talar process to serve as a benchmark for position as well as a second point of fixation (Figure 7).

Ankle/Rearfoot Arthrodesis

Figure 7A is a case of significant architectural deformation secondary to Charcot Neuroosteoarthropathy. The patient was free of infection with a significant equinovarus deformity and obliteration of the rearfoot joints ongoing for 5 years. Over that time span the patient was only able to ambulate with crutches placing no weight on the left lower extremity.

Steinman pins 2.0-3.0 mm (5/64 – 1/8 inches) were employed to stabilize the sizeable joints of the rearfoot/ankle (Figure 7B). Exit of the tibial cortex is intended to improve boney purchase and enhance stability following a wedge osteotomy resection.

A stable fibrous union with definitive correction of the equinovarus deformity (Figure 7C). The patient is able to ambulate in a diabetic shoe with a build up without the use of assistive devices.

CONCLUSION

K-wires and Steinmann pins are versatile in lieu or in combination with other forms of fixation. Wires and pins can be used as the primary choice of fixation and achieve satisfactory results when coupled with sound surgical technique.

Regrettably, complications can occur with any fixation technique. K-wires and Steinman pins are associated with loosening and external migration, pin tract irritation, and infections[9]. (Figure 9) Pins are known for dislodgement despite precautionary measures such as the use of threaded pins and bending of the distal end in geriatric patients[10].

K-wires and Steinmann pins are simple and inexpensive devices (Figure 10). With ever-rising cost of implants and other fixation devices, perhaps it is time for the future to meet the past.

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Figure 10: OrthoMed 2015 Promotion Prices on Kirschner Wires (A) and Steinmann Pins (B)

A. KIRSCHNER WIRES SMOOTH (PKG SIX)

Inches	Diameter					Price
DOUBLE ENDED TROCAR						
4”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
5”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
6”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
9”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
12”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
SINGLE TROCAR round end						
4”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
5”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
6”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
9”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
DOUBLE END DIAMOND						
4”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
5”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
6”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
9”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
SINGLE DIAMOND round end						
4”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
9”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29
12”	0.028”(0.7mm)	0.035”(0.9mm)	0.045”(1.1mm)	0.054”(1.4mm)	0.062”(1.6mm)	$12.29

B. STEINMANN PINS SMOOTH (PKG SIX)

Inches	Diameter							
Promo Price	$13.40	$15.75	$17.90	$23.90	$31.90	$39.40	$43.55	$59.00
DOUBLE END TROCAR								
9”	5/64”(2.0mm)	3/32”(2.4mm)	7/64”(2.8mm)	1/8”(3.2mm)	9/64”(3.5mm)	5/32”(4.0mm”	0.177”(4.5mm)	3/16”(4.8mm)
SINGLE TROCAR round end								
9”	5/64”(2.0mm)	3/32”(2.4mm)	7/64”(2.8mm)	1/8”(3.2mm)	9/64”(3.5mm)	5/32”(4.0mm”	0.177”(4.5mm)	3/16”(4.8mm)

Overuse of CT Pulmonary Angiography

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barriers to implementation of decision rules for PE in the ED and to formulate strategies for overcoming these barriers. Future investigations are needed to evaluate the ability of electronic clinical decision support to aid in the assessment of pretest probability. Larger studies showing a significant benefit of decision rules over gestalt for suspected PE are also likely needed, to persuade physicians of the worth of these diagnostic tools.

LIMITATIONS:

1. Our study population was confined to ED patients undergoing CT- PA for the evaluation of suspected PE.
2. We did not include patients evaluated for PE who did not have imaging, or underwent an alternative imaging modality such as ventilation/perfusion scanning. Consequently, our study does not provide an estimate of the overall frequency of use of decision rules in the management of patients with suspected PE.
3. Treating clinicians were not questioned as to their clinical gestalt or pretest probability for PE, nor to their reasoning for whether or not to use a clinical decision rule.
4. The study was conducted at one ED, so the results may not be generalizable to other EDs in other settings.
5. The sample size of the study population was small.
6. We did not include D-dimer testing and PERC criteria for PE.

CONCLUSIONS

We found that a clinically meaningful percentage of computed tomography pulmonary angiography in patients presenting to the ED with suspected pulmonary embolism could have been potentially avoided through use of validated clinical decision rules. A simple evaluation with Wells score could have prevented patients exposure to unnecessary testing and exposure to contrast and radiation side effects on short and long term as well as decreasing the hospital and medical care expenses.

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Patient Transfers

(cont. from page15)

find a confounder or documented rational for this finding. That raises a concern whether convenience for physicians played a role in this trend. Due to relatively small number of transfers we were not able to track whether those transfers, that were managed conservatively at the UH had any connection to the timing of the transfers. We did not find unexpected changes in the rate of transfers in relation to holidays or business vs non-business hours.

Review of the insurance status showed no influence on transfer decision process, as 94% of patients transferred had insurance. That is similar to 96% of overall patients admitted to the SVCMC and national average of 95%.

Our findings create a background for further analysis of the outcomes of the transfers and the cost involved, not only from the SVCMC side but overall including transfer cost, redundancy of tests and procedures, etc. Further studies of the all the factors influencing decision-making process with evaluation of the outcomes of transfers are necessary. That will aid development of more translucent criteria and infrastructure for transfers, and will help to improve not only patients' outcomes and satisfaction but improve healthcare economy as well.

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