

Augusta - Clinical Oncology - Hosted by the CT Commission on Cancer

Santosh Swaminathan MD	Saint Mary's Hospital
Santosh Swaminathan MD	Saint Mary's Hospital
Sue Ting Lim MD	Saint Mary's Hospital
Alexander Frey MD	Yale School of Medicine
Andrew Seto MD	Stamford Hospital
Richard Maduka MD	Yale School of Medicine
Tomasz Kasprzycki MD	Frank H Netter Quinnipiac School of Medicine - WH
Richard Maduka MD	Yale School of Medicine
Sean Ramras MD	Frank H Netter Quinnipiac School of Medicine - WH

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Kathleen O'Neill MD, PhD	Yale New Haven Hospital
Sean Ramras MD	Frank H Netter Quinnipiac School of Medicine - WH
Leah Aakjar MD	University of Connecticut
Nicholas Druar MD, MPH	Saint Mary's Hospital
Suraj Panjwani MD	St. Mary's Hospital
Santosh Swaminathan MD	Saint Mary's Hospital

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Shayan Ahmed MD	Saint Mary's Hospital
Tian Sheng Ng MD	Saint Mary's Hospital

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Tiahna Spencer MD	UConn Health

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Medical Student Research- Hosted by the CTACSPA

Olohirere Ezomo MPH	Frank H. Netter MD School of Medicine at QU
Blake Acquarulo MPH	Frank H. Netter MD School of Medicine at QU
Olohirere Ezomo MPH	Frank H. Netter MD School of Medicine at QU
Ian Whittall BA	University of Connecticut School of Medicine
Shashwat Kala BA	Yale School of Medicine

Global Research Trends on the impact of the COVID 19 pandemic on Orthopedic
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 The BITE Score: a Novel Scoring System to Improve Dog Bite Care in Children
 Ethnoracial Disparities in Surgical Pediatric Cancer Care During the COVID-19 Par

Providence - Metabolic & Bariatric Surgery - Hosted by CT Chapter ASMBS

Sue Ting Lim MD	Saint Mary's Hospital
Joseph Carbonaro BS	Frank H. Netter MD School of Medicine at QU
Katarina Bade BS	Trinity College
Santosh Swaminathan MD	Saint Mary's Hospital
Santosh Swaminathan MD	Saint Mary's Hospital
Chelsea Paterson MD	Saint Mary's Hospital

Thioredoxin-1 Overexpression Ameliorates the Progression of Diabetic Cardiomy
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Boston - Surgical Quality, NSQIP and ERAS - Hosted by the CtSQC

Alexander Ostapenko Dr	Danbury Hospital
Josh Sznol MD	Yale School of Medicine
Nupur Nagarkatti MD	Yale School of Medicine
Pharis Sasa BS	Spine Institute of CT
Samuel M. Miller MD	Yale School of Medicine
Thomas Tritt MD	Stamford Hospital
Suraj Panjwani MD	St. Mary's Hospital
Tyler Glaspy MD	Danbury Hospital

Synchronous major hepatic resection with primary colorectal cancer increases ri
 Adverse Impact of Ascites on Outcomes of Open Inguinal Hernia Repair in the Ur
 Is Patient Sex Associated with Surrogate Consent for Surgical Intervention?
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 Effects of Physician Education on the Identification of Moderate and Severe Mal
 Bearing of BMI on Surgical Outcomes After Ostomy Reversal-NSQIP Analysis
 Role of Ablation Therapy in Conjunction with Surgical Resection for Neuroendoc

Concord - Surgical Subspecialties- Hosted by the CTACSPA

Austin Alecxih BS	Frank H. Netter MD School of Medicine at QU
Brienne Ryan, MD	Connecticut Children's Medical Center
Krist Aploks MD, MBA	Danbury Hospital
Minha Kim MD	Danbury Hospital
Nicolle Burgwardt MD	Stamford Hospital
Sue Ting Lim MD	Saint Mary's Hospital
Olohirere Ezomo MPH	Frank H. Netter MD School of Medicine at QU

BIOMECHANICS OF THE PROXIMAL TIBIOFIBULAR JOINT: QUANTIFYING NORMAI
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 Neoadjuvant radiation therapy prior to a pancreaticoduodenectomy for adenoc
 Pancreatic Paraganglioma and Hyperparathyroidism in a Patient with RET Gene \
 Patent Urachus in Neonate Requiring Surgical Repair
 Prolyl-4-Hydroxylase 2 (PHD-2) Inhibition Promotes Pro-angiogenic and Anti-apo
 The Association between Quadriceps Weakness and Persistent Knee Pain after T

Surgical Specialties - Hosted by the CTACSPA

Biomechanics of the Proximal Tibiofibular Joint: Quantifying Normal Motion

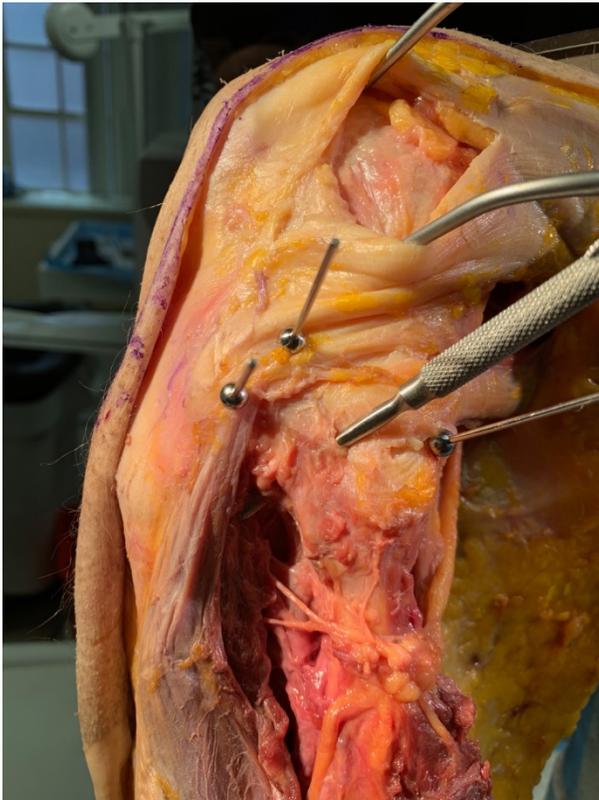
Kristofer Chenard MD (Spine & Orthopedic Center), Austin Alexih MS BS (Frank Netter MD School of Medicine), Matthew Gotlin MD (Lenox Hill Hospital), Benjamin Bedford MD (Specialty Orthopedics/Lenox Hill Hospital), Stephen Nicholas MD (Specialty Orthopedics/Lenox Hill Hospital)

Introduction: The normal range of motion at the proximal tibiofibular joint is unknown. Injuries to the proximal tibiofibular joint (PTFJ) can occur in isolation or combined with other ligamentous injuries of the knee, including injury of the posterolateral corner. Recent studies have demonstrated that anatomic posterolateral corner reconstructions are unable to restore varus and external rotation stability if concomitant disruption of the PTFJ has occurred.¹² Instability of the PTFJ is most notable at 90 degrees of knee flexion, however, normal and pathologic motion have not yet been defined.

Methods: We immobilized 10 human cadaver knees proximally and distally at a flexion angle of 90 degrees. We placed two convergent kirschner wires, one in the proximal fibula, and one in the proximal tibia, to provide reference points for measurement. Anterior, posterior, and lateral translation from the reduced position were measured after the application of a 30N force at the fibular neck.

Results: The mean anterior fibular translation was 2.4 mm (+/-1.0mm), the mean posterior fibular translation was 2.4 mm (+/-1.0 mm) and the mean lateral translation was 2.0 mm (+/-1.2 mm). The mean maximum total translation from anterior to posterior (anterior plus posterior translation) was 4.8 mm (+/-2.0 mm). Nine out of ten specimens had a total anterior to posterior translation less than 6mm; the remaining specimen was noted to be ligamentously lax and had a total range of 10 mm.

Conclusions: Quantification of physiologic motion at the proximal tibiofibular joint provides a basis upon which treating providers can predicate their assessment of joint stability. PTFJ joint motion in excess of physiologic parameters enters into a pathophysiologic range that may need to be addressed clinically to restore knee stability, especially in the context of a concomitant posterolateral corner injury.¹²³



1. Treme GP, Salas C, Ortiz G, et al. A Biomechanical Comparison of the Arciero and LaPrade Reconstruction for Posterolateral Corner Knee Injuries. *Orthop J Sport Med.* 2019;7(4):2325967119838251. doi:10.1177/2325967119838251
2. Kruckeberg BM, Cinque ME, Moatshe G, et al. Proximal Tibiofibular Joint Instability and Treatment Approaches: A Systematic Review of the Literature. *Arthrosc J Arthrosc Relat Surg.* 2017;33(9):1743-1751. doi:10.1016/j.arthro.2017.03.027
3. Jabara M, Bradley J, Merrick M. Is Stability of the Proximal Tibiofibular Joint Important in the Multiligament-injured Knee? *Clin Orthop Relat Res.* 2014;472(9):2691-2697. doi:10.1007/s11999-014-3574-1

Esophageal Stenosis Secondary to Cavitory Lesions: A Unique Presentation of Dysphagia

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Introduction: Feeding and swallowing disorders can have multiple underlying causes including medical, behavioral, and environmental. The differential can include neuromuscular disorders, infectious, anatomic abnormalities of the aerodigestive tract and genetic abnormalities. It often requires a multidisciplinary team to elucidate the underlying cause. Surgical consultation is necessary for certain anatomic conditions including congenital esophageal stenosis, stricture, esophageal atresia or tracheoesophageal fistulas, all of which may require surgical intervention. These conditions prevent proper swallowing and increase the risk of aspiration, often requiring prompt surgical repair. In this case report, we present a unique patient who developed esophageal stenosis secondary to infectious cavitory lesions.

Case: Patient is a 3 week old infant born at 39.2 weeks gestation with post-natal course complicated by meconium aspiration syndrome, GERD/oropharyngeal dysphagia with aspiration requiring NGT feeds and antibiotics who presented with increased secretions, vomiting and intolerance of feeds. Patient was noted to have frothy, foaming secretion and desaturations during feeding. Infectious work up revealed likely aspiration pneumonia for which IV clindamycin was initiated. Infectious disease, neurology, and ENT were consulted. Patient underwent barium swallow to evaluate esophagus which showed narrowing in esophagus with pouching noted proximal and thin trickle of contrast distally into stomach, however imaging was unable to fully assess caliber of distal esophagus due to upstream narrowing. At this time, surgery was consulted for suspected esophageal stricture versus stenosis. Of note, patient had previously undergone UGI at an OSH after birth which showed slow esophageal passage, but did not show any obstruction. The tentative plan was that once patient recovered from her PNA, she would undergo bronchoscopy and EGD with possible esophageal dilation.

In the interim, A CT scan was obtained which showed multiple pulmonary masses demonstrating various degrees of cavitation, most consistent with septic emboli as well as mass effect upon the distal esophagus which appeared to be secondary to a cavitory lesion of the right lower lobe. In an effort to optimize nutrition and minimize further risk for aspiration, an NGT was placement under fluoroscopy. Pulmonology and hematology was consulted given pulmonary lesions and possibility of oncologic etiology. Echocardiogram was performed which showed no vegetations, and US neck/upper extremities was performed without identified thrombi. Tuberculosis was deemed unlikely given negative TST. Although an intrinsic inflammatory component was not completely ruled out, the decision was made to follow the patient with serial imaging while continuing antibiotics to evaluate whether reduction in the size of the cavitory lesions would lead to improved aspiration symptoms. The patient was continued on Unasyn, an replegle remained in place to assist with secretions and the patient eventually underwent laparoscopic gastrostomy tube placement.

A repeat CT was obtained on hospital day 13 which showed significant interval improvement in the multiple pulmonary cavitory masses, A repeat esophagram on hospital day 20 showed persistent dilatation of the proximal thoracic esophagus with persistent marked narrowing of the mid to distal esophagus over a length of 1.5 cm, however slight improvement in passage of contrast into the stomach.

Discussion: Feeding and swallowing disorders have numerous etiologies. Anatomic abnormalities of the aerodigestive tract including esophageal stenosis, stricture, and esophageal atresia with and without fistulization often require prompt surgical intervention to optimize nutrition and prevent sequelae such as aspiration pneumonia or esophageal perforation. Esophageal strictures can be caused by intrinsic pathologies including trauma such as corrosive esophageal injury, gastroesophageal reflux disease, or esophagitis. We present a case of extrinsic compression of the esophagus secondary to an infectious etiology, requiring numerous interventions including nasogastric tube replacement and laparoscopic gastric tube placement. Despite continued regression of the lesions after antibiotic treatment, the patient continues to have stenosis requiring tube feeds and replegle placement to assist in secretion removal. Further imaging and interventions may be required after resolution of the infectious process, and additional work up into the etiology of the lesions is ongoing.

Neoadjuvant Radiation Therapy Prior to a Pancreaticoduodenectomy for Adenocarcinoma Correlates with Longer Operative Times and Perioperative Blood Loss.

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Introduction: Pancreatic adenocarcinoma today represents the fourth most common cause of cancer-related death in the United States. In patients with “borderline resectable” disease, current NCCN guidelines recommend the use of neoadjuvant chemoradiation prior to a pancreaticoduodenectomy. While neoadjuvant radiotherapy in particular has been shown to incur long term morbidity and mortality benefits, it is theorized that its administration may increase total operative time and case complexity. The purpose of this study is to determine whether there is an association between neoadjuvant radiotherapy, total operative time, and perioperative transfusion requirements among patients receiving a pancreaticoduodenectomy for pancreatic adenocarcinoma.

Methods and procedures: Using the 2015-2019 NSQIP data set, we performed a retrospective analysis on patients receiving a pancreaticoduodenectomy for pancreatic adenocarcinoma. Dividing patients into two groups based off of neoadjuvant radiotherapy status, we used multivariate logistical and negative binomial regression to determine if there is a statistically significant correlation between neoadjuvant radiotherapy and our outcome variables (perioperative blood transfusion and total operative time).

Results: Out of the total 11,458 patients included in the study, 1,470 (12.8%) underwent neoadjuvant radiation. Using multivariate logistical regression to control for confounding factors, patients who received neoadjuvant radiotherapy were significantly more likely to require a perioperative blood transfusion compared to those that did not (aOR = 1.55, 95% CI = 1.34, 1.78, $p < 0.01$). Using multivariate negative binomial regression, we also found that surgeries in patients who received neoadjuvant chemotherapy were (on average) 14 minutes longer than those in patients who received no such therapy (IRR= 1.14, 95% CI = 1.11, 1.16, $p < 0.01$).

Conclusions: The results of our study support the hypothesis that neoadjuvant radiotherapy increases total operative time and perioperative blood transfusions in patients who receive it compared to those that do not. This is likely secondary to radiation’s effect on the pancreas, which has been theorized to change the texture of the pancreas and distort tissue planes. Although longer operative times and a greater likelihood of perioperative blood transfusions do not necessarily correlate with increased surgical complexity, these factors must be kept in mind when operating on previously irradiated patients.

Pancreatic Paraganglioma and Hyperparathyroidism in a Patient with *RET* Gene Variant Mutation

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Introduction: Paraganglioma (PGL) are rare extra-adrenal neuroendocrine tumors that can form within sympathetic and parasympathetic ganglia throughout the body. Although all PGLs arise from neural crest-derived chromaffin cells, these tumors differ with regards to function (ability to produce and secrete catecholamines), location, and malignant potential. PGLs are associated with germline mutations in a variety of genes, including *RET*. *RET* is proto-oncogene that has been associated with the multiple endocrine neoplasia type 2 (MEN2) syndrome. Individuals with *RET* mutations leading to MEN2 are at risk for developing hyperparathyroidism, medullary thyroid cancer, and pheochromocytomas/paraganglioma. The University of Utah MEN2 and *RET* genetic database has documented approximately 200 different mutations, most of which have not been characterized. Here, we describe a patient with a history of hyperparathyroidism who developed a pancreatic retroperitoneal paraganglioma and was found to have a variant of *RET* mutation with unknown significance, which has not been documented in the University of Utah MEN2 and *RET* genetic database.

Method: Literature review of paragangliomas

Case Presentation: A 64-year-old Caucasian male initially presented to his primary care physician only complaining of gradual right hip pain for more than two months. His medical history was significant for left parathyroidectomy for a parathyroid adenoma and well-controlled hypertension. Family history elicited prostate cancer in the patient's father. Imaging revealed mild degenerative changes in the spine and a 11 cm ovoid, solid, enhancing mass in the right mid-abdominal mesentery. Biopsy of the mass revealed an atypical epithelioid and spindle cell neoplasm. The patient underwent an elective exploratory laparotomy and resection of the retroperitoneal tumor. Patient's histologic evaluation and tumor immunohistochemistry were consistent with metastatic PGL. With the diagnosis of PGL, catecholamine levels were obtained and found to be elevated. He underwent genetic testing, which revealed a variant of the *RET* gene with unknown significance (c.731C->T (p.T244I)). To rule out MEN2 related tumors and metastatic disease, patient had ultrasound of the thyroid and PET dotatate scan, which was negative for any pathology.

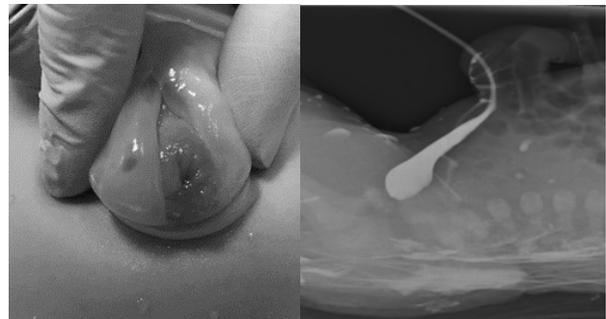
Discussion: Genetic testing is recommended for any patient diagnosed with PGLs, since roughly 40% carry germline mutations. The *RET* proto-oncogene, commonly associated with PGLs, has also been linked to MEN syndromes types 2A, 2B, and familial medullary thyroid carcinoma. Due to the fact that different mutations to the *RET* gene can result in wide range of effects, attempts have recently been made to catalog the phenotype of individual mutations for prognostic purposes. Our patient was found to have a retroperitoneal paraganglioma associated with a *RET*T244I germline mutation. This mutation, as of yet, has not been listed in the University of Utah MEN2 and *RET* genetic database. The variant has been reported once in the ClinVAR database as a variant with unknown significance. Despite his isolated history of parathyroid adenoma and the identified paraganglioma, our patient did not meet criteria for a diagnosis of any established *RET*-associated syndrome. His long-term prognosis remains uncertain so he will require close surveillance to assess for recurrence or metastatic disease.

Patent Urachus in Neonate Requiring Surgical Repair

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Introduction: Urachal anomalies are uncommon congenital malformations, with patent urachus incidence reported as 1-2 in 100,000 deliveries. Presentation of urachal anomalies can range from abnormal navel appearance, including edematous umbilicus, weeping, and granulomas, to constant drainage of urine. Imaging is required for the definitive diagnosis of a patent urachus. Currently, surgery is the mainstay of treatment for symptomatic urachal anomalies. We present the case of a neonate with a true patent urachus requiring surgical management.

Case Presentation: Our patient was a 0-day-old male born full term from uncomplicated pregnancy, who was found to have an abnormal umbilicus in the delivery room. Prenatal ultrasound had identified an uncomplicated "umbilical cyst." A pediatric surgical consult was called to further evaluate. On abdominal exam, the baby had a 2cm wide mass at the base of the cord, which appeared like a stoma with central lumen, intermittently draining clear fluid. The lumen was cannulated for about 10cm with a feeding tube and additional clear fluid was drained. A bedside contrast study revealed a patent urachus with communication with the bladder dome, and the decision was made to proceed with urachal excision and bladder repair.



Intraoperatively, a 5Fr feeding catheter was used as a urinary catheter, which when placed, protruded from the central lumen observed in the umbilicus. An infraumbilical incision was made and the urachus was dissected free of the abdominal wall and umbilical cord structures, taking care to stay extraperitoneal. The urachal remnant was amputated at the level of the bladder

dome. The bladder dome was repaired in two layers. The umbilical cord was amputated at the level of the abdominal wall, and the defect was circumferentially closed with a purse string suture. Post-operatively, the baby had minimal umbilical drainage. His urinary catheter was removed POD2 and he was discharged home POD3 voiding freely. One month post-operatively, the umbilicus was well healed and VCUg revealed normal appearing bladder with no evidence of persistent urachal defect.

Discussion: The urachus is the embryologic remnant of the cloaca and allantois. The allantois is an extraembryonic diverticulum from the posterior yolk sac and the cloaca is an endoderm-lined structure which divides into the urogenital sinus and rectum. The superior portion of the urogenital sinus develops into the bladder. Its apex forms the bladder dome and is contiguous with the allantois. Both structures involute and elongate into a fibromuscular cord as the bladder descends into the pelvis around the 4th gestational month. This urachal remnant connects the apex of the bladder to the umbilicus, traveling along the extraperitoneal space of Retzius. It contains epithelial, submucosa and muscular layers, is 8-10mm in diameter, and ranges from 3-10cm in length. Urachal remnants are present in almost 100% of neonates and obliterate due to fibrosis, forming the median umbilical ligament. Any degree of obliteration failure may result in a urachal anomaly.

A patent urachus is one of four types of urachal anomalies: urachal fistula (patent urachus), urachal cyst, umbilical urachal sinus, and vesico-urachal diverticulum. There has been an increase in diagnosis of asymptomatic urachal anomalies with the routine use of cross-sectional imaging. Before the increase in incidental diagnoses, approximately 300 symptomatic cases were reported in the literature between 1550-1970. A patent urachus is the most common of the urachal anomalies, accounting for roughly 50%, and its incidence is approximately 1-2 in 100,000 deliveries. A true patent urachus is characterized by free and persistent communication with the bladder leading to urine leakage from the umbilicus. It is rarely asymptomatic. There is a higher prevalence in males, 2:1.

A patent urachus most often presents at birth with urine leakage and associated umbilical abnormalities, including edema, granulomas, and delayed cord stump healing. The differential diagnosis for an umbilical mass in a neonate can range from a pyogenic granuloma to umbilical hernia to urachal anomaly. The presentation of umbilical abnormalities can overlap, making a correct diagnosis crucial for appropriate management. Definitive diagnosis is made with imaging, usually ultrasound or cystography, demonstrating a fistulous connection of the bladder to the umbilicus.

Surgery is the mainstay of treatment for patients with a symptomatic urachal anomaly. There is a small risk of malignant degeneration of the epithelial layer, most often urothelium. The incidence of urachal adenocarcinoma accounts for 0.01% of all cancer in adults. In addition to mitigating this small risk of malignancy, the goal of surgical therapy for a patent urachus is to remove the fistula. This is accomplished by excising the entire urachal remnant, repairing the bladder dome, excising remaining cord structures, and closing of the abdominal wall fascial defect. Our case illustrates that while uncommon, a patent urachus should be considered in a neonate with an umbilical abnormality.

Prolyl-4-Hydroxylase 2 (PHD-2) Inhibition Promotes Pro-angiogenic and Anti-apoptotic Signaling and Preserves Cardiac Function in a Murine Genetic Myocardial Infarction Model

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Introduction: We have previously reported that the stabilization of hypoxic-inducible transcription factor (HIF1- α) by suppressing prolyl-4-hydroxylase enzymes (PHD-1 and PHD-3) results in improved angiogenesis, cardiac function and limb perfusion in murine models. This study explores the inhibitory effects of another prolyl-4-hydroxylase enzyme, PHD-2 in ischemic heart failure. We used mouse cardiac-specific PHD-2 gene knockout model to study its effects on angiogenic factors, cell survivability and cardiac function in myocardial infarction(MI).

Methods: The left anterior descending artery is ligated in 8-12 weeks old wild-type (WTMI) and PHD2^{-/-} mice (PHD2^{-/-}MI) to induce MI. Cardiac function was obtained using echocardiography. Left ventricular tissues were obtained at 4 and 30-days post-MI. Echocardiographic analysis was performed 30-days post-MI followed by immunohistochemistry to determine the extent of fibrosis and vessel growth. Western blot(WB) was performed to determine proangiogenic and anti-apoptotic factors.

Results: Echocardiography at 30-days post-MI shows a greater ejection fraction (52.02±3.2% vs. 27.85±3.12%, p<0.0001) and fractional shortening (26.88 ±1.9% vs. 13.14±1.63%, p<0.0001) in PHD2KO as compared to WT(n=9). WB shows increased HIF-1a (36-fold), VEGF (11-fold), phospho-AKT (4.3-fold), b-Catenin (19-fold) levels along with reduced Bax expression (3.6-fold) and myocardial fibrosis (3.8±1.4% vs. 15.5±5%, p=0.048) in PHD2^{-/-}MI compared to WTMI group(n=6).

Conclusion: Inhibition of PHD2 is cardioprotective as evident by preserved cardiac function, increased expression of angiogenic factors, and reduction of apoptotic markers. Overall, PHD2 gene inhibition is a promising candidate in the management of cardiovascular disease.

The Association between Quadriceps Weakness and Persistent Knee Pain after Total Knee Arthroplasty – A Systematic Review.

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Importance: Total Knee Arthroplasty (TKA) is one of the most common surgical procedures performed for the definitive treatment of knee osteoarthritis. With more patients undergoing the procedure in recent years, there has been a lot of focus on improving patient outcomes such as postoperative TKA pain and optimizing post-operative functional status. Unfortunately, despite recent technological and surgical technique advances, some patients continue to experience unexplained persistent knee pain after TKA. There are some proposed theories that have sought to explain the association between quadriceps weakness (QW) and persistent knee pain after TKA, with the goal of improving overall patient outcome.

Objective: To examine existing data to 1) present recent knowledge on QW and associated persistent knee pain after TKA and 2) highlight areas for further research.

Methods: We carried out an extensive review of the literature using 3 databases – Google Scholar, PubMed and Scopus from year 2000 – 2020. Inclusion criteria were articles published in peer reviewed journals from 2000-2020 and written in English. Exclusion criteria were book chapters, theses, commentaries, case reports and case series; articles published before year 2000 were also excluded. We compiled and presented data from selected articles to discuss the present state of knowledge with respect to quadriceps weakness and postoperative TKA persistent pain.

Results: Several factors have been discussed in the literature that predict postoperative TKA outcomes, such as preoperative quadriceps weakness and comorbidity status, such as smoking and body mass index (BMI). Reduced muscle activation, usually from pain around the knee joint, has been demonstrated to be central to the mechanism of developing quadriceps weakness both pre-and postoperatively. The reduced muscle activation comes from the acute postoperative knee pain and swelling after TKA. This then leads to quadriceps weakness and if the quadriceps do not gain strength adequately after TKA, could subsequently cause knee instability and persistent knee pain as a long-term sequela. In return, the persistent knee pain can further worsen and lead to chronic quadriceps weakness post TKA. Thus, creating a vicious cycle between quadriceps weakness and persistent knee pain after TKA.

Conclusion: QW is an understudied yet important predictive factor for postoperative TKA pain. Optimization of quadriceps strength could improve persistent knee pain and patient outcomes after TKA

S/N	Study/ Year	Title	Type of study	Result	Conclusion	LOE
1.	Breugem et al/ 2014.	Anterior Knee pain after TKA: What can cause this pain?	Systematic review	Noiceptors around the knee are numerous and activated by abnormal mechanical deformation, soft tissue overloading and stretching.	Further research on the complex interaction of factors causing knee pain after TKA need to be investigated	V
2.	Berth et al/ 2002.	Improvement of voluntary quadriceps muscle activation after TKA	Case control. 50 patients undergoing TKA and 23 healthy controls.	Voluntary quadriceps muscle activation and maximal contraction increased after TKA but remained lower to non-operated side and controls.	Voluntary activation deficits persist 3 years after TKA	IV
3.	Rice et al/ 2010	Quadriceps arthrogenic muscle inhibition: Neural mechanism and treatment perspectives	Systematic review	Arthrogenic muscle inhibition can delay or prevent quadriceps muscle strength recovery for months after TKA. Even though, arthrogenic muscle inhibition reduces over time, quadriceps inhibition often persists for years after TKA	Arthrogenic muscle inhibition's neural mechanism needs to be better understood to help rehabilitation efforts after TKA	V
4.	Kim et al/ 2019	Central sensitization is a risk factor for persistent postoperative pain and dissatisfaction in patients undergoing revision TKA	Case control study	Persistent knee pain post-TKA led to poor patient satisfaction rates. Central sensitization changes the way the central nervous system works, with patients becoming more sensitive to pain. It also predicted pre- and post-TKA persistent knee pain	Central sensitization is a risk factor for persistent knee pain post revision TKA	IV
5.	Gungor et al/ 2019	Incidence and risk factors for development of persistent postsurgical pain following TKA	Cross-sectional/ Observational	Risk of developing persistent postsurgical pain after TKA was 31.3%. African Americans had a higher risk compared to Whites. Higher pre-operative pain scores predict the risk of developing persistent postsurgical pain after TKA	Racial differences and type of peripheral nerve block may play a role in the development of persistent postsurgical knee pain after TKA	VI
6.	Mizner et al/ 2005	Early quadriceps strength loss after TKA: the contributions of muscle atrophy and failure of voluntary muscle activation	Cross-sectional/ Observational	After TKA, quadriceps strength and voluntary activation reduces by 62% and 17% respectively, with reduced voluntary activation and atrophy predicting 85% loss of quadriceps strength one month after TKA. Improved knee pain after TKA did not improve voluntary muscle activation	Pain control alone may not be sufficient to increase muscle strength after TKA	VI
7.	Loyd et al/ 2019	Peripheral nociception is associated with voluntary activation deficits and quadriceps weakness following TKA	Cross-sectional/ Observational	Postoperative quadriceps weakness is significantly explained by deficits in voluntary activation. Knee pressure-pain threshold change was also significantly associated with the change in quadriceps strength and activation	Study lends evidence to a causal pathway between increased knee nociceptor firing and reduced quadriceps activation and strength after TKA	VI
8.	Kim et al/ 2018	The effects of pain on quadriceps strength, joint proprioception and dynamic balance among women aged 65 to 75 years with knee osteoarthritis.	Cross-sectional / Observational	Knee extensor muscle strength was lower in osteoarthritic knee compared to the non-osteoarthritic knee at angular velocities of 60 and 180 degrees - 55 vs 63 Nm and 38 vs 45 Nm respectively.	Patients with knee osteoarthritis had weaker quadriceps strength in the painful knee.	VI
9.	Christensen et al/ 2018	Quadriceps weakness preferentially predicts detrimental gait compensations among common impairments after TKA	Cross-sectional/ Observational	Persistent quadriceps weakness after TKA predicts physical performance and knee loading at least 6 months after surgery	Quadriceps femoris strength asymmetry improved over time while residual knee pain and extensor power remained the same	VI
10.	Marmon et al/ 2014	Activation deficits do not limit quadriceps strength training gains in patients after TKA	Randomized Controlled Trial	Pain post TKA contributes to muscle activation deficits but is not a predictive factor for muscle strength gain after TKA	Quadriceps muscle activation does not predict muscle strength 3 months after TKA	III
11.	Paravlic et al/ 2018	Neurostructural correlate of strength decrease following TKA: A systematic review of the literature with meta-analysis.	Meta-analysis	Change in voluntary muscle activation accounted for 39% of change in quadriceps strength of the operated leg after TKA. Maximal voluntary contraction strength of the quadriceps starts to recover after 1.5 months post TKA and returned to pre-operative values about 33 months post TKA	Other neurological mechanisms such as antagonistic hamstring activation may be contributory to quadriceps weakness after TKA	I
12.	Breugem et al/ 2014	No difference in anterior knee pain between a fixed and a mobile posterior stabilized TKA after 7.9 years	Randomized Controlled Trial	13% of posterior stabilized fixed patients experienced persistent anterior knee pain compared to 17% for the posterior stabilized mobile cohort after 6-10 years of follow up. However, the difference was not significant. Persistent anterior knee pain after TKA significantly affects the daily activities that patients can perform after TKA	Fixed or mobile implants had no predictive value on the incidence of persistent knee pain post TKA on the long term	III
13.	Breugem et al/ 2008	Less anterior knee pain with a mobile bearing prosthesis compared with a fixed bearing prosthesis	Randomized Controlled Trial	18.9% of posterior stabilized fixed patients experienced persistent anterior knee pain compared to 4.3% for the posterior stabilized mobile cohort after 1 year of follow up. Both cohorts had similar postoperative improvement in functionality and range of motion of the patients	Posterior stabilized mobile bearing was associated with lower incidence of anterior knee pain 1-year post TKA	III