more drinks in one occasion for men [women]), cigarette smoking (former/current), and depressive symptoms (Patient Health Questionnaire-9 score ≥ 10) and incident CVD through 14 years. Clinical ICD-9 codes identified incident cases of CVD (acute myocardial infarction, heart failure, revascularization, and stroke). We constructed age-adjusted survival curves and CVD rates. Multivariable Cox proportional hazards regressions estimated the hazard ratio (HR) and 95% confidence intervals (CI) of the syndemic score on incident CVD by HIV status, adjusting for baseline demographic, health status, and HIV-related factors. RESULTS/ANTICIPATED RESULTS: Under 10% of all veterans had zero conditions; 25.8% had one; 49.6% had two, and 14.3% had all three. Based on the prevalence of each individual condition in the cohort (unhealthy drinking: 41.5%, cigarette smoking: 75.0%, and depressive symptoms: 21.3%), the observed prevalence of all three conditions was more than double that expected by chance (6.6%). There were 835 cases of incident CVD (50.4% HIV+) during the median follow-up (10.6 years). Overall, age-adjusted incidence rates/1000 person-years increased with greater number of conditions (zero 10.1, one 12.5, two 15.8, three 19.6). Compared to uninfected people with zero conditions, the adjusted hazard ratios of incident CVD were similar by HIV status for each number of conditions. DISCUSSION/SIGNIFICANCE OF IMPACT: The syndemic of unhealthy drinking, cigarette smoking, and depressive symptoms is common and associated with high CVD risk. However, this risk was similar by HIV status. Our results underscore the need to screen for and treat these co-occurring conditions.

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Associations of aspirin, non-aspirin NSAIDs, statins, and metformin with risk of biliary cancer: A Swedish population-based cohort study

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OBJECTIVES/SPECIFIC AIMS: In an effort to elucidate the role of potentially cancer chemopreventive drugs, we leveraged the Mayo Clinic-Karolinska Institute collaboration to create a multidisciplinary team that included an epidemiologist, statisticians, and physicians. We performed a population-based cohort study to examine the association between low dose aspirin, non-aspirin NSAIDs, statins, metformin, other risk factors and the risk of biliary tract cancer (BTC), while assessing confounding by sex. METHODS/STUDY POPULATION: We conducted a nationwide Swedish population-based cohort study using the Swedish Prescribed Drug Registry, which virtually completely enumerates use of prescribed medications nationwide since 2005. BTC diagnosis (intrahepatic cholangiocarcinoma [iCCA], extrahepatic cholangiocarcinoma [eCCA] or gallbladder cancer [GBC]) was ascertained from the Swedish Cancer Registry. Age-scaled Cox models, with exposure as time-varying covariates, were used to calculate hazard ratios (HRs), separately for men and women. RESULTS/ANTICIPATED RESULTS: In the 5.7 million person cohort, the risk of iCCA was significantly lower in men using statins (HR 0.62,95%CI 0.39-1.00, p = 0.05), with a non-significant reduction in women. Statin use was associated with a significantly decreased risk of eCCA in both women (HR 0.60, 0.38-0.94, p = 0.03) and men (HR 0.47,0.28-0.80, p = 0.01). Low dose aspirin (HR 0.76,0.60-0.97, p = 0.03) was associated with a lower risk of GBC only in women, while statins (HR 0.72,0.55-0.93, p = 0.01) showed a significantly decreased risk of GBC in women and a non-significant reduction in men. For all BTC subtypes, combined use of low dose aspirin and statins did not confer additional risk reductions beyond those achieved by statins alone. Male and female users of non-aspirin NSAIDs appeared to be at increased risk of BTC and its subtypes. Metformin did not significantly affect risk of BTC. DISCUSSION/SIGNIFICANCE OF IMPACT: Our collaborative efforts allowed us to develop the largest population-based cohort evaluating risk and protective factors for BTC. Our results provide strong evidence in favor of the chemopreventive roles of low dose aspirin and statins in a subtype- and sex-specific manner. Individual risk factors contribute to development of BTC subtypes in different magnitudes. The next steps to translate these findings into clinical practice require randomized clinical trials that validate our results and provide a more complete picture of the risk-benefit ratio.

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Biomarkers of Stroke Recovery Study

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OBJECTIVES/SPECIFIC AIMS: There are currently no established blood-based biomarkers of recovery and neural repair following stroke in humans. Such biomarkers would be extremely valuable for aiding in stroke prognosis, timing rehabilitation therapies, and designing drugs to augment natural repair mechanisms. Metabolites, including lipids and amino acids, are engaged in many cellular processes and cross the blood-brain barrier more easily than proteins. Recent advances in liquid chromatography / mass spectrometry (LCMS) allow researchers to obtain a biochemical fingerprint of the metabolites in various biofluids. Thus, metabolite biomarkers of neural repair after brain injury are a promising avenue for future research. Objective: Design and conduct a study to identify metabolite changes in the blood associated with good and poor motor recovery following stroke. METHODS/STUDY POPULATION: We launched the Biomarkers of Stroke Recovery (BIOREC) study, which seeks to enroll 70 participants suffering arm motor impairment following stroke and 35 matched controls. BIOREC is a longitudinal observational study. Fasting blood samples are collected at 5, 15, and 30 days post-stroke, processed, and stored in the Georgetown Lombardi biorepository. Outcome measures, including measures of motor impairment, cognition and language, are assessed at 5, 15, 30, and 90 days post-stroke. The primary outcome measure is the upper extremity Fugl-Meyer score. Control participants are matched for age +/− 1 yr, race, gender, cardiovascular comorbities, and statin use through a computer algorithm that screens the entire MedStar electronic health record (EHR). Control participants provide 2 fasting blood samples one month apart. Once all samples are collected and sent for LCMS analysis, logistic regression analysis will identify potential metabolite biomarkers by comparing participants with good recovery to those with poor recovery as well as stroke participants to controls. RESULTS/ANTICIPATED RESULTS: To date, forty stroke participants have enrolled from 4 acute care hospitals in the Washington, DC metro region and completed all study procedures. Twenty stroke participants either dropped out or were withdrawn due to other medical concerns. Stroke patients ended up at a variety of venues following their acute hospitalization including the acute rehabilitation hospital, skilled nursing facilities, and home. We learned to overcome these logistical challenges by traveling to wherever the patients were sent

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and notifying medical providers of their study participation. In rare cases we have paid to transport patients from skilled nursing facilities to the clinic, which has reduced dropouts. In addition to the stroke participants, we have enrolled 7 healthy control participants using the EHR screening algorithm. DISCUSSION/SIGNIFICANCE OF IMPACT: Performing a longitudinal study in the early recovery phase following stroke is logistically challenging, but feasible. Difficulty in identifying participants with isolated motor impairment requires added effort to eliminate dropouts. Screening the EHR is an effective method to identify matched controls. Future metabolomics analysis of stored blood samples holds promise to identify biomarkers of stroke recovery and neural repair.

3159

Bone Turnover Biomarkers May Discriminate Low Bone Mineral Density in HIV-Infected Adults

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OBJECTIVES/SPECIFIC AIMS: Persons living with HIV (PLWH) are at increased risk for fragility bone disease. Current osteoporosis screening guidelines do not account for HIV status, and clinical risk assessment tools are not sensitive in PLWH. We examined the value of traditional osteoporosis risk factors, HIV-specific indices, and bone turnover biomarkers in predicting low bone mineral density (BMD) in PLWH. METHODS/STUDY POPULATION: Demographic and clinical characteristics, dual energy x-ray absorptiometry (DXA)-derived BMD, HIV indices (viral load, CD4 count, antiretroviral therapy [ART]), and biomarkers of bone turnover (C-terminal telopeptide of collagen [CTx], osteocalcin [OCN]) were evaluated in a cross-sectional analysis of PLWH (n=248) and HIV- controls (n=183). The primary outcome was low BMD, defined as osteopenia or osteoporosis by WHO criteria. Multivariable logistic and modified Poisson regression models were used to assess associations between low BMD and covariates of interest. RESULTS/ANTICIPATED RESULTS: Overall, median age was 44 years, 48% were male, 88% were black, median body mass index (BMI) was 28 kg/m2, 72% smoked cigarettes, and 53% used alcohol; characteristics did not differ by HIV status. PLWH had a mean CD4 of 408 cells/mm3, 55% were ART-naïve, and 45% had viral suppression on ART. Overall, 25% (109/431) had low BMD, including 31% of PLWH compared to 16% of HIV- controls. In multivariable models, HIV was significantly associated with low BMD (aOR 2.46, 95%CI 1.39-4.34; aRR 1.90, 95%CI 1.18-3.07). Adjusting for HIV, three traditional risks– age, race, and BMI– were independently associated with low BMD in the full cohort. However, bone turnover markers, CTx and OCN, were better able to discriminate low vs. normal BMD in PLWH compared to HIV- controls. In PLWH, mean serum CTx was 23% higher in low vs. normal BMD (mean CTx difference= 0.06 ug/mL); in HIV- controls, no association with BMD was observed (mean CTx difference=0 ug/mL). In PLWH, mean serum OCN was 38% higher in those with low vs. normal BMD (mean OCN difference=2.48 ug/mL); in HIV- controls, mean serum OCN was only 16% higher in those with low vs. normal BMD (mean OCN difference=1.08 ug/mL). DISCUSSION/SIGNIFICANCE OF IMPACT: In PLWH as opposed to HIV- controls, serum biomarkers reflecting a high bone turnover state, may discriminate individuals with low versus normal BMD. Because changes in biomarkers precede changes in BMD, these markers should be explored further either alone or in combination with traditional risk assessment tools to improve early screening for osteoporosis in PLWH.

3517

Cancer-Related Pain is a Predictor of In-hospital Opioid Overdose among Postoperative patients

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OBJECTIVES/SPECIFIC AIMS: Our study's primary aim is to determine if there is an association between cancer-related pain among patients who underwent major elective procedures and postoperative opioid overdose. In addition, the relationship between cancer-related pain in this population and inpatient mortality, total hospital charge and length of stay was assessed. METHODS/STUDY POPULATION: Our study sample consisted of adults 18 years and older who had at least one of eight elective procedures. Data was obtained from the National Inpatient Sample (NIS). Variables were identified using ICD-9 codes. Our primary predictor was cancer-related pain while our primary outcome was opioid overdose. Secondary outcomes were inpatient mortality, length of stay and total charge. Propensity-matched regression models were employed in assessing the association between cancer-related pain and outcomes of interest. RESULTS/ANTICIPATED RESULTS: Among 4,085,355 selected patients, 0.8% (n = 2,665) had cancer-related pain while 99.92% (n = 4,082,690) had no diagnosis of cancer-related pain. All subjects with cancer-related pain (n = 2,665) were successfully matched to subjects with no diagnosis of cancer-related pain in a 1:5 ratio yielding 13,325 controls. Patients with cancer-related pain had significantly higher odds of opioid overdose (aOR 4.82 [95% CI [2.68-8.67]; p-value <0.0001) and inpatient mortality (aOR 1.39[1.11-1.74]; p-value 0.0043). Patients with cancer-related pain were also likely to stay significantly longer in the hospital (12.76 days vs. 7.88 days) with significantly higher total hospital charges ($140,220 vs. $88,316). DISCUSSION/SIGNIFICANCE OF IMPACT: Pain is a common complication of cancer pathogenesis, diagnosis or treatment. Though a rare outcome, opioid overdose could lead to undesirable outcomes. Cancer patients undergo invasive diagnostic and therapeutic procedures as part of their cancer management or for conditions not related to their primary cancer diagnosis. Safety measures including alternatives to opioids are recommended to prevent the poor clinical outcomes and higher healthcare utilization indices associated with opioid overdose in this population.

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Cannabis use and risk of H. pylori infection; analysis of inpatients and residents of the US.

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OBJECTIVES/SPECIFIC AIMS: Cannabinoids suppress gastric acid secretion, ameliorate gastric inflammation, and promote gastric ulcer healing, all of which are triggered by H pylori (Hp). Our aim was to determine the relationship between cannabis use and: 1) H pylori infection (HPI) among community residents 2) clinical

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